

The proposed standard requires maintenance and inspection of the building system components that directly affect IAQ. Specifically, the HVAC system should provide at least the outside air ventilation rate based on actual occupancy, building code, mechanical code or ventilation code and that carbon dioxide concentration does not exceed 800 parts per million. In approximately 500 indoor air quality investigations, NIOSH found that the primary cause of indoor air quality problems is inadequate ventilation (52 percent).

Other actions required include: (1) control of humidity in buildings with mechanical cooling systems, (2) implementing the use of general or local exhaust ventilation where maintenance and housekeeping activities involve use of equipment or products which emit air contaminants in other areas of the facility, (3) maintain mechanical equipment rooms and any non-ducted air plenums or chases in a clean condition.

OSHA recognizes that not every building will have to make all recommended changes to improve operation and maintenance of the HVAC system. In the majority of the cases, some improvements can be accomplished by changing the setting on a control device or centralized control system. Depending on the condition of the HVAC equipment, inspection and maintenance may include simple housekeeping of equipment and air transport pathways and/or catastrophic failure maintenance to repair/replace failed equipment. Also, there may be cases where a number of buildings will require major changes in the HVAC system such as enlarging the size of the outside air intake.

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The cost for providing maintenance first requires an estimate of the number of buildings without regular HVAC maintenance. The 1989 Commercial Buildings Characteristics survey by the Department of Energy estimates that 46 percent of the buildings have regular HVAC maintenance. Therefore, the total number of building requiring maintenance is estimated at 2.3 million. OSHA then determined the number of problem buildings without HVAC maintenance by applying the OSHA estimate of 30 percent (presented in section B). The number of problem buildings without HVAC maintenance is estimated at 0.7 million.

In general, the average cost per year to maintain a commercial HVAC system is a function of a number of factors. These factors include the type of system, the age of the system, the size of the system, layout of the system, reliability of the equipment installed. In addition to the physical characteristics of the system, the cost per year to maintain the system also depends on the operation of the system, the maintenance policies of the owner, the skill levels of the operating engineers and maintenance workers, and whether the maintenance is carried out by employees of the building owner or is the responsibility of an outside company.

Bank of America's maintenance costs for its 2,000 worksites averaged \$4 million per year or an average of \$2,000 per worksite [Ex. 3-552]. One facility, a high-rise office building, reported an annual cost of approximately \$0.6 million [Ex. 3-448]. DOW Chemical Company's estimate for ventilation systems maintenance ranges from \$0.17 to \$0.25/sq.ft./yr [Ex. 3-502]. Therefore,

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OSHA used an average of \$0.21/sq.ft/yr to compute the cost of HVAC maintenance.

In addition to regular HVAC maintenance, buildings with known IAQ problems will require other improvements such as (1) relocating air intakes and other pathways of building entry to restrict the entry of outdoor air contaminants, or (2) installing local source capture exhaust ventilation or substitution within workspaces where air contaminants are being emitted, or (3) increasing ventilation effectiveness, or (4) reduce unwanted infiltration, or (5) monitor outside air quantity to meet ventilation requirements. The National Energy Management Institute developed a cost model for implementing IAQ improvements which is based on the distribution of buildings with IAQ problems by climate zone, building activity and size, and characteristics of ventilation systems. The average cost to implement the actions listed above are estimated to be \$1.14 per square foot. These improvements will only be required for the initial year.

The cost equation for implementing the compliance program is as follows:

$$C_p = M_s ( N_h \times C_a + N_p \times C_a + N_p \times C_i \times A_{20} )$$

where   
  $C_p$  = cost for providing regular HVAC maintenance  
  $M_s$  = mean square footage per building (14,000)  
  $N_h$  = number of buildings without HVAC maintenance  
  $C_a$  = cost per square foot for providing HVAC maintenance (\$0.21)  
  $N_p$  = number of problem buildings without HVAC maintenance  
  $C_i$  = cost per square foot for providing HVAC maintenance and IAQ improvement actions (\$1.14)  
  $A_{20}$  = Annualization factor at 10% over 20 years (0.117)

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Non-recurring first year costs were annualized over 20 years at 10 percent interest rate. As presented in Table VI-10, the annualized first-year cost is estimated at \$1.3 billion. OSHA anticipates total annual costs of \$8.0 billion.

c) Training for HVAC Maintenance Workers and Informing Employees About the Indoor Air Quality Standard

The proposed standard requires training for all building maintenance workers involved in building system operation and maintenance. Standards of maintenance vary dramatically in the HVAC industry and sometimes are deficient where untrained personnel are designated to maintain very complex systems.

Training programs for workers must include at least information on: (1) how to maintain adequate ventilation of air contaminants generated during building cleaning and maintenance, and (2) how to minimize adverse effects on indoor air quality during the use and disposal of chemicals and other agents.

The exact cost of training will vary among establishments depending on whether employees are trained in-house or sent to outside training programs or consultants. OSHA estimated the costs for the trainer who must research, prepare and direct the sessions. For the time involved in the training session, a range of costs for the instructor could be developed. For example, the wage costs for the trainer could represent from 50 percent of the trainee labor costs (if there are only two in the class) to 5 percent if there are 20 trainees in a class. For the preparation time, OSHA judged that the trainer will require a special study seminar, such as that taught by the Building Owners and Managers

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**Table VI-10**  
**Cost for System Operation and Maintenance Provision**

	Buildings with IAQ Problems and without HVAC Maintenance			Buildings without HVAC Maintenance and without IAQ Problems			Total Annual Cost (\$million)	
	Number of Buildings with HVAC	Annualized <sup>1</sup> Cost to Improve IAQ (\$million)		Number of Buildings <sup>2</sup>	Annual Cost <sup>3</sup> (\$million)			
		Cost to Improve IAQ (\$million)	Annual Cost (\$million)		(\$million)	(\$million)		
AGRICULTURE, FORESTRY, FISHING	26,139	\$49	\$77	60,990	\$179	\$305		
MINING	2,291	\$4	\$7	5,346	\$16	\$27		
CONSTRUCTION	64,442	\$121	\$189	150,364	\$442	\$752		
MANUFACTURING	39,027	\$73	\$115	91,062	\$268	\$456		
TRANSPORTATION	24,432	\$46	\$72	57,007	\$168	\$285		
WHOLESALE AND RETAIL TRADE	193,423	\$363	\$569	451,320	\$1,327	\$2,258		
FINANCE, INSURANCE, REAL ESTATE	52,756	\$99	\$155	123,098	\$362	\$616		
SERVICES	193,810	\$363	\$570	452,222	\$1,330	\$2,263		
GOVERNMENT	87,086	\$163	\$256	203,200	\$597	\$1,017		
<b>Total</b>	<b>683,404</b>	<b>\$1,281</b>	<b>\$2,009</b>	<b>1,594,610</b>	<b>\$4,688</b>	<b>\$7,979</b>		

<sup>1</sup> Number of problem buildings X \$1.14 per sq.ft. X 14,000 sq.ft. (mean floorspace/building), annualized over 20 years at 10% interest rate.

<sup>2</sup> Recurring cost estimated for number of problem buildings without HVAC maintenance using \$0.21/sq.ft.

<sup>3</sup> Number of non-problem buildings without maintenance X 14,000 sq. ft (mean floorspace per building) X \$0.21 per square foot

Source: OSHA, Office of Regulatory Analysis, 1994.

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Association International. OSHA assumed that the labor costs for the trainer and preparation time are approximately equal to 25 percent of the trainee's wage cost during the session. OSHA also assumed that 50 percent of the workers will require such training. The cost equation for maintenance workers training is as follows:

$$C_t = N_m \times P_m \times W_m \times T_m$$

where  $C_t$  = the cost of training of maintenance workers  
 $N_m$  = the number of maintenance workers<sup>10</sup>  
 $P_m$  = the percentage of existing compliance as estimated by OSHA (50 percent)  
 $W_m$  = the hourly compensation wage rate for maintenance workers (\$10.95)  
 $T_m$  = one-half hour of maintenance worker time plus 7.5 minutes for trainer cost (37.5 minutes)

The total cost of training is estimated at \$6.84 per maintenance worker for a half hour program. Table VI-11, presents OSHA's estimate for the number of maintenance workers needing training and the associated costs. The annualized first year cost is estimated at \$0.5 million. It was assumed that job changes within establishments or buildings will require retraining. The annual new hire cost is estimated at \$0.8 million, based upon industry turnover rates. Thus OSHA estimated annualized cost training to be \$1.3 million.

The proposed standard requires employers to inform all employees of the contents of the standard and its appendices. This could be accomplished by posting the proposed standard at a

<sup>10</sup> The number of maintenance workers is based on BLS's Occupational Employment Statistics survey of 1992 and includes all maintenance workers who perform work involving two or more maintenance skills to keep machines, mechanical equipment, or structure of an establishment in repair.

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bulletin board; therefore, OSHA did not include a cost for this provision.

d) Compliance with Related Standards

The proposed standard requires employees performing work on HVAC systems to comply with several existing OSHA standards and therefore any costs associated with compliance with this provision have already been considered. This requirement is necessary to protect employees from exposure to indoor air pollutants and exposure to noise. This provision is considered to have a de minimus effect on all industries and OSHA believes that establishments are in full compliance with this requirement.

e) Air Contaminant-Environmental Tobacco Smoke

The primary objective of the tobacco smoke provision is to eliminate the nonsmoker's exposure to ETS. Under the proposed rule, firms will have the option of either banning smoking of tobacco products or permitting smoking only in designated areas.

OSHA recognizes that not all establishments will make available designated smoking areas as there may be physical constraints on the option of providing separate ventilation. Such constraints are imposed by the building's design, the building's mechanical ventilation system's capabilities, by costs involved in providing adequate ventilation, by the occupant use of the building. In some cases, establishments located in severe climate zones may find it necessary to protect their smoking employees from weather exposure by providing designated smoking areas. Establishments in large high rise buildings may also find

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**Table VI-11**  
**Training Cost for Maintenance Workers**

	Building Maintenance Workers	Maintenance Employees to be Trained <sup>1</sup>	Annualized Initial Cost <sup>2</sup> (\$million)	Annual New Hire Training Cost (\$million)	Annual Cost (\$million)
AGRICULTURE, FORESTRY, FISHING	26,210	13,105	\$0.015	\$0.01	\$0.01
MINING	5,460	2,730	\$0.003	\$0.00	\$0.01
CONSTRUCTION	73,060	36,530	\$0.041	\$0.07	\$0.11
MANUFACTURING	205,660	102,830	\$0.115	\$0.18	\$0.29
TRANSPORTATION	47,720	23,860	\$0.027	\$0.02	\$0.04
WHOLESALE AND RETAIL TRADE	143,440	71,720	\$0.080	\$0.12	\$0.20
FINANCE, INSURANCE, REAL ESTATE	172,350	86,175	\$0.096	\$0.17	\$0.26
SERVICES	236,160	118,080	\$0.132	\$0.26	\$0.39
GOVERNMENT	NA	NA	NA	NA	NA
<b>Total</b>	<b>910,060</b>	<b>455,030</b>	<b>\$0.507</b>	<b>\$0.82</b>	<b>\$1.31</b>

<sup>1</sup> Based on preliminary OSHA estimate of 50 percent existing compliance.

<sup>2</sup> Initial costs are annualized over 10 years at a 10 percent interest rate.

Training for maintenance workers is estimated to take one-half hour. Compensation wage rate is \$10.95 per hour. Cost includes an additional 7.5 minutes per employee to cover trainer cost. Total training cost per employee is \$6.84.

NA: Data not available.

Source: OSHA, Office of Regulatory Analysis, 1994.

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it desirable to provide such rooms to facilitate break periods. Consequently, in order to reflect the degree to which establishments will provide separate smoking areas, OSHA developed some estimates based on the characteristics of the stock of buildings and the percentage of companies currently banning smoking in the workplace.

OSHA has no data on the number of establishments currently permitting smoking in designated smoking areas. OSHA estimated that 50 percent of large establishments with floor space greater than 100,000 square foot and with more than three floors will provide designated smoking areas. OSHA also assumed that 50 percent of all eating and drinking places and hotels and other lodging places may provide separate designated smoking areas. For these establishments, OSHA then applied the percentage of companies that will ban smoking based on the rates provided from a survey conducted by the Administrative Management Society Foundation (AMS) on current practices for smoking policies in the workplace. According to the survey, 25 percent of the companies completely ban smoking on their premises. However, the percentages varied by SIC as follows: manufacturing (23%), transportation and utilities (36%), banking and finance (28%), insurance (38%), retail and wholesale (7%), and services (18%). Also, 72 percent felt that smoking in the workplace should be either banned or restricted [H-030 - Ex. 75].

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Firms opting to make available designated smoking areas are expected to incur initial capital costs. OSHA assumed that in many cases existing rooms or offices can be converted into a designated smoking area. Average cost estimates for retrofitting

the HVAC system ranges from \$4,000 for a 150 square feet room (which could accommodate up to 10 smokers) [Ex. 4-265] to \$25,000 for 1,000 square feet (which could accommodate 30 to 65 smokers) [Ex. 3-643]. The HVAC retrofit represented in these estimates typically includes: (1) blocking off the return air inlet from the room, (2) providing a transfer air path, and (3) providing an exhaust fan and exhaust air pathway to the outside. The exhaust fan capacity would exceed air supplied to the room in sufficient quantity to create a negative pressure in the smoking room relative to surrounding areas to ensure containment of the contaminant. In order to achieve negative pressure some architectural modifications may be necessary to provide a tight enclosure. OSHA did not estimate an additional cost for housekeeping since such activities would have been performed prior to the promulgation of the proposed standard.

Most facilities exhaust air from toilet rooms and also relieve air brought in for ventilation and economizer cooling<sup>10</sup>. The amount of exhaust air from a designated smoking area is inconsequential compared with the quantities of air leaving the building through toilet room exhaust and relief. Therefore, OSHA did not include recurring cost for the provision of a separately ventilated smoking area.

The equation for determining cost for allowing smoking in designated areas is as follows:

$$C_s = (N_e \times (1-P_s) + N_d \times (1-P_{sm})) P_c \times C_r$$

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<sup>10</sup> use of outside air for cooling - "free cooling".

where

$C_s$	=	cost for providing designated areas
$N_e$	=	number of establishments in buildings with 3 or more floors and floorspace greater than 100,000 sq.ft.
$P_s$	=	percentage of establishments banning smoking
$N_d$	=	50 percent of establishments in Eating and Drinking Places (SIC 58), and Hotel (SIC 70)
$P_{sm}$	=	percentage of establishments in SIC 58 and SIC 70 banning smoking
$P_c$	=	percentage of establishments providing designated smoking areas (50%)
$C_r$	=	cost for setting up a separate smoking area (\$4,000 for a 150 sq.ft. room that accommodates up to 10 smokers, furnishings existing)

Initial costs are annualized over 20 years at 10 percent interest rate. As presented in Table VI-12, the total annual cost is estimated at \$68 million. OSHA did not include a cost estimate for the government sector at this time.

f) Air Quality during Renovation and Remodeling

The proposed standard requires that during renovation and remodeling appropriate controls are utilized to minimize degradation of the indoor air quality of employees performing such activities and employees in other areas of the building. The basic characteristics of available control practices include: ventilation system/high efficiency particulate air (HEPA) vacuum; regulated areas, isolation or containment of work areas and appropriate negative pressure containment; outside air intakes, return/recirculation air streams or plenums; notification of employees and contractors.

For buildings with asbestos presence, the control practices under the OSHA asbestos standard are current industry practice. A survey developed for obtaining information on practices to control exposure to asbestos in buildings shows that asbestos

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**Table VI-12**  
**Optional Cost for Providing Separate Smoking Areas**

	Number of Establishments Providing Designated Smoking Areas <sup>1</sup>		Annualized First-Year Cost <sup>2</sup> (\$million)
	in Single Establishment Buildings	in Multi- Establishment Buildings	
AGRICULTURE, FORESTRY, FISHING	43	8	\$0.024
MINING	4	1	\$0.002
CONSTRUCTION	105	21	\$0.059
MANUFACTURING	65	13	\$0.037
TRANSPORTATION	34	7	\$0.019
WHOLESALE AND RETAIL TRADE	93,411	36,058	\$60.829
FINANCE, INSURANCE, REAL ESTATE	83	16	\$0.046
SERVICES	11,188	3,968	\$7.121
<b>Total</b>	<b>104,932</b>	<b>40,091</b>	<b>\$68.138</b>

<sup>1</sup> Number of establishments adjusted for percentage banning smoking as follows: Manufacturing 23%; Transportation and Utilities 36%; Wholesale and Retail 7%; average rate for all other industries 25%.

Number of establishments included represent 50 percent of large establishments in buildings with 3 or more floors and with floor space greater than 100,000 sq. ft.

Number of establishments include 50% of all establishments in SIC 58 (Eating and Drinking places) and 70 (Hotels).

<sup>2</sup> Cost for making ventilation changes is estimated at \$4,000/smoking room which accommodates up to 10 smokers.

Initial costs are annualized over 20 years at a 10 percent interest rate.

Source: U.S. Department of Labor, OSHA, Office of Regulatory Analysis, 1994.

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related work represents 16 percent of renovation activities whereas general remodeling is 61 percent and major repair and maintenance are 12 percent [Ex. 4-64]. More than half of the buildings sampled were occupied during renovation activities. However, all projects in which asbestos-related work was being performed were sealed off from the building occupants. A variety of renovation projects were performed in buildings ranging in project area from 15 to 900,000 square feet, in duration from one to 156 weeks and in cost from \$700 to more than \$10 million. The average cost was approximately \$0.3 million and the average duration for a project was 13 weeks.

However, no data are available on the cost to provide controls required under the proposed IAQ standard or for current industry compliance for chemical exposure other than exposure to asbestos. OSHA assumed minimal cost due to the nature of these processes.

#### F. ECONOMIC IMPACT AND REGULATORY FLEXIBILITY ANALYSIS

The previous section presented the costs to all industries of complying with the proposed standard. This chapter examines projected economic and environmental impacts on those industries. OSHA developed quantitative estimates of the economic impact of the proposed standard on the affected industries. Data on profits are presented to illustrate the scale of profitability of affected industries and do not necessarily represent their ability to pay for proposed standard provisions.

OSHA assessed the potential economic impacts and has preliminarily determined that the standard is economically

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feasible for each of the major industry groups that will be affected. OSHA conducted its analysis at the two digit SIC level. This has been OSHA's procedure for doing regulatory impact analyses for other proposed standards. OSHA preliminarily concludes that this is reflective of the actual impact on the average firm within each subsector. It does not appear that the affected groups will experience significant adverse economic impact as a result of the standard. However, if any interested person has information to show that the analysis at the two digit level is not representative of the potential economic impact of the proposal, OSHA requests the following information: reasons why the preliminary regulatory analysis is not reflective of the actual anticipated costs in any particular sector; specific information as to why the analysis at the two digit level fails to adequately represent the economic impact; and specific information to help OSHA to better predict the impact on the sector in question. Such information should be included in the comments on the proposal.

In accordance with the Regulatory Flexibility Act of 1980, OSHA additionally examined the potential for an unduly burdensome impact on small entities. OSHA believes that the standard will not have significant adverse effect on a substantial number of small entities. However, OSHA requests comment on those workplaces for which compliance with the proposed standard would prove economically and technologically challenging (e.g., restaurants, bars and other "public" places where employees are exposed to customer's tobacco smoke). While it is technologically feasible to ban smoking in those establishments,

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there may be other countervailing problems, legal and economic, which OSHA should consider.

### 1) Economic Feasibility

In order to determine the economic feasibility of the rule, OSHA compared estimated compliance costs with: (1) the value of sales and (2) before-tax profits. All financial data developed for this analysis are based on information from Dun and Bradstreet's annual credit survey. Aggregate sales data for 1991 were taken from the D&B Market Identifiers data base [Exs. 4-94, 4-95, 4-96]. Mean profit rates (profit as a percentage of sales) were taken from D&B's Insight data base; OSHA averaged data for 1990, 1991 and 1992<sup>11</sup>.

Using a conversion formula<sup>12</sup> based on the federal corporate tax schedule, OSHA calculated pre-tax profits from its estimate for post-tax profits. It should be noted that the sales and profit data, while the most recent available, reflect conditions during a cyclical trough; therefore, impacts may depict a worst case scenario. In the case of the federal government sector, price increases for services rendered may not apply. Budgets are usually fixed (in the short run) and

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<sup>11</sup> Dun's Insight computer data base presents data from their three most recent annual industry Norms and Key Business Ratios publications. For most industry groups, OSHA averaged data for three years.

<sup>12</sup> This conversion implicitly assumes individual business establishments are separate corporations. Because more than one establishment may be grouped together for tax purposes, the conversion will tend to underestimate pre-tax profits. State, local and other business taxes have not been factored into the conversion formula. Additionally, because average tax rates may decline as pre-tax profits decline, the after-tax impact to the company may be less than suggested here.

compliance costs are paid by reducing funds for other items in the budget.

Where industry enjoys an inelastic demand for its product, an increase in operating costs can ordinarily be passed on to consumers. In this case, the maximum expected price increase is calculated by dividing the estimated compliance cost for each industry by the sales for that industry. Table VI-13 shows that the average price increase related to the cost of this proposed standard would be extremely small, 0.07 percent, with the largest being 0.41 percent (Personal Services, SIC-72). The results in Table VI-13 indicate that even if all costs were passed on to consumers through price increases, the rule would have a negligible impact on prices.

In many industries, however, establishments will not be able to pass along the entire cost of compliance through price increases since consumers may respond by reducing demand. Such establishments will have to absorb from profit the costs they cannot pass through. If all costs were absorbed from profit, the maximum expected decrease in profit can be calculated by dividing the estimated compliance cost for each industry by its estimated profit. Table VI-13 shows that the average decline in profits under this worst-case-elasticity assumption would be less than 0.94 percent. The largest potential decline in profits would be in Fishing at 4.5 percent (SIC-9).

Because most establishments will not find it necessary to absorb all of the costs from profits and will be able to pass some of the costs on to consumers, average profits will not decline to the extent calculated in this analysis. OSHA believes

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**Table VI-13**  
**Economic Impact of the Proposed Indoor Air Quality Standard**

	Total Annualized Costs (\$Millions)	Value of Industry Shipments (\$Millions)	Pre-tax Profit (\$million)	Revenue	Compliance Cost as a Percent of Profit
<b>AGRICULTURE, FORESTRY, FISHING</b>	\$306.1	\$121,090	\$10,914	0.25%	2.80%
01 Agriculture Production - Crops	\$123.6	\$45,703	\$4,363	0.27%	2.83%
02 Agriculture Production - Livestock	\$60.4	\$34,770	\$2,810	0.17%	2.15%
07 Agricultural Services	\$114.8	\$35,723	\$3,302	0.32%	3.48%
08 Forestry	\$3.4	\$2,910	\$351	0.12%	0.96%
09 Fishing	\$4.0	\$1,984	\$88	0.20%	4.48%
<b>MINING</b>					
13 Oil and Gas Extraction	\$26.8	\$483,892	\$46,190	0.01%	0.06%
<b>CONSTRUCTION (SIC 15, 16 &amp; 17)</b>	\$754.7	\$546,422	\$32,424	0.14%	2.33%
<b>MANUFACTURING</b>	\$457.3	\$5,078,549	\$305,701	0.01%	0.15%
20 Food and Kindred Products	\$27.7	\$602,970	\$29,539	0.00%	0.09%
21 Tobacco Manufacturers	\$0.2	\$172,271	\$19,228	0.00%	0.00%
22 Textile Mill Products	\$8.1	\$95,923	\$5,378	0.01%	0.15%
23 Apparel and Textile Products	\$29.9	\$92,305	\$5,454	0.03%	0.55%
24 Lumber and Wood Products	\$45.0	\$75,417	\$4,152	0.06%	1.09%
25 Furniture and Fixtures	\$12.9	\$60,540	\$3,547	0.02%	0.36%
26 Paper and Allied Products	\$8.2	\$197,037	\$10,946	0.00%	0.08%
27 Printing, Publishing, & Allied Industries	\$79.1	\$226,709	\$17,175	0.03%	0.46%
28 Chemicals & Allied Products	\$15.6	\$600,941	\$36,117	0.00%	0.04%
29 Petroleum Refining and Related Industries	\$2.7	\$482,927	\$24,148	0.00%	0.01%
30 Rubber and Miscellaneous Plastic Products	\$18.6	\$128,846	\$8,134	0.01%	0.23%
31 Leather and Leather Products	\$2.6	\$24,954	\$1,601	0.01%	0.16%
32 Stone, Clay, Glass, & Concrete Products	\$19.3	\$98,947	\$5,827	0.02%	0.33%
33 Metal Industries	\$8.6	\$187,162	\$9,831	0.00%	0.09%
34 Fabricated Metal Products	\$41.9	\$211,787	\$12,515	0.02%	0.33%
35 Machinery, Except Electrical	\$66.4	\$602,629	\$41,393	0.01%	0.16%
36 Electrical Machinery, Equipment & Supplies	\$21.1	\$296,011	\$16,744	0.01%	0.13%
37 Transportation Equipment	\$16.1	\$641,556	\$34,670	0.00%	0.05%
38 Professional & Photographic Equipment & Watches	\$14.1	\$218,279	\$14,442	0.01%	0.10%
39 Misc & Not Specified Manufacturing Industries	\$19.2	\$63,337	\$4,862	0.03%	0.40%
<b>TRANSPORTATION</b>	\$286.1	\$1,470,658	\$157,739	0.02%	0.18%
41 Local and Intercity Transit	\$21.2	\$24,654	\$1,158	0.09%	1.83%
42 Trucking and Warehousing	\$134.6	\$161,093	\$8,049	0.07%	1.67%
44 Water Transportation	\$8.3	\$44,646	\$3,315	0.02%	0.25%
45 Air Transportation	\$11.3	\$155,387	\$7,926	0.01%	0.14%
46 Pipelines, Except Natural Gas	\$1.2	\$9,819	\$3,382	0.01%	0.03%
47 Transportation Services	\$49.7	\$113,689	\$6,890	0.04%	0.72%
48 Communications	\$34.4	\$414,216	\$72,174	0.01%	0.05%
49 Electric, Gas, and Sanitary Services	\$25.4	\$527,155	\$54,845	0.00%	0.05%
<b>WHOLESALE AND RETAIL TRADE</b>	\$2,325.9	\$4,466,839	\$212,377	0.05%	1.10%
50 Wholesale Trade, Durable Goods	\$432.2	\$1,014,451	\$51,235	0.04%	0.84%
51 Wholesale Trade, Nondurable Goods	\$256.3	\$1,162,472	\$48,730	0.02%	0.53%
52 Building Materials and Garden Supplies	\$79.5	\$107,704	\$4,950	0.07%	1.61%
53 General Merchandise Stores	\$40.1	\$338,896	\$18,828	0.01%	0.21%
54 Food Stores	\$184.6	\$516,213	\$18,250	0.04%	1.01%
55 Automobile Dealers and Related Products	\$208.8	\$490,377	\$14,860	0.04%	1.41%
56 Apparel and Accessories Stores	\$139.6	\$139,673	\$11,498	0.10%	1.21%
57 Furniture and Home Furnishing Stores	\$122.6	\$133,023	\$8,398	0.09%	1.46%
58 Eating and Drinking Places	\$509.2	\$243,437	\$13,770	0.21%	3.70%
59 Miscellaneous Retail Stores	\$353.0	\$320,594	\$21,859	0.11%	1.61%
<b>FINANCE, INSURANCE, REAL ESTATE</b>	\$618.0	\$2,904,557	\$86,820	0.02%	0.71%
60 Banking	\$78.5	\$848,335	NA	0.01%	NA
61 Credit Agencies Other Than Banks	\$37.2	\$245,431	\$32,724	0.02%	0.11%
62 Security and Commodity Brokers and Dealers	\$30.9	\$228,859	\$13,638	0.01%	0.23%
63 Insurance Carriers	\$49.0	\$1,061,799	NA	0.00%	NA
64 Insurance Agents, Brokers and Service	\$135.2	\$140,251	NA	0.10%	NA
65 Real Estate, Insurance, Etc.	\$263.8	\$243,871	\$25,619	0.11%	1.03%
67 Holding & Other Investment Offices	\$23.5	\$136,010	\$14,837	0.02%	0.16%
<b>SERVICES</b>	\$2,276.9	\$2,545,462	\$201,141	0.09%	1.13%
70 Hotels and Other Lodging Places	\$66.3	\$97,230	\$7,169	0.07%	0.92%
72 Personal Services	\$204.1	\$49,263	\$5,225	0.41%	3.91%
73 Business Services	\$367.1	\$452,305	\$42,032	0.08%	0.87%
75 Auto Repair, Services, and Garage	\$181.6	\$103,150	\$7,502	0.18%	2.42%
76 Miscellaneous Repair Services	\$78.7	\$34,536	\$3,384	0.23%	2.32%
78 Motion Pictures	\$47.1	\$74,819	\$8,915	0.06%	0.68%
79 Amusement and Recreation, Exc. Motion Pictures	\$90.7	\$66,954	\$4,937	0.14%	1.84%
80 Health Services	\$496.3	\$592,679	\$38,913	0.06%	1.28%
81 Legal Services	\$166.0	\$85,154	\$14,364	0.19%	1.16%
82 Educational Services	\$36.1	\$418,120	\$21,540	0.01%	0.17%
83 Social Services	\$128.6	\$54,928	\$3,301	0.23%	3.90%
84 Museums and Botanical and Zoological Gardens	\$3.2	\$3,797	\$501	0.09%	0.65%
86 Membership Organizations	\$111.0	\$99,831	\$6,050	0.11%	1.84%
87 Engineering, Accounting, Research and Related Services	\$290.6	\$338,363	\$31,273	0.09%	0.93%
89 Miscellaneous Services	\$9.4	\$74,332	\$8,034	0.01%	0.12%
<b>GOVERNMENT</b>	\$1,017.2	NA	NA	0.07%	0.94%
	\$8,069.13				

Sources: Dun and Bradstreet Market Identifier's data base, 1993.  
Insight: Industry Norms and Key Business Ratios, 1992.

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that these impacts are not large enough to impair economic viability. While some marginal firms might be more seriously impacted, extensive economic dislocation is not expected to occur in any industry. OSHA has, therefore, preliminarily determined that the standard is economically feasible.

## 2. Regulatory Flexibility Analysis

The proposed IAQ standard will affect numerous small establishments and a portion of these establishments may have difficulty financing the compliance actions needed to comply depending on which alternative they choose. This section examines the potential for exceptional impacts among small establishments.

The nature of compliance action limits the potential for exceptionally large compliance burdens on small businesses because most costs will be incurred on a per employee or per square foot basis. The number of buildings occupied with establishments with fewer than 20 employees is estimated at 3.7 million or 82 percent of all buildings. Of these, 76 percent have floor space less than 10,000 square feet. Thus, small firms will incur low costs because they have small floorspace and few employees.

To this point of the analysis, OSHA has not distributed the number of buildings across establishments since there are no data on which to describe the establishments in multi-tenant buildings. Therefore, OSHA developed establishment specific compliance costs based on the estimates presented in section E of this report. The economic impact by firm size is estimated with

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the assumption that all establishments will require HVAC maintenance. It was assumed that each establishment has a floor space of 10,000 square feet. To examine the potential regulatory burden that would be experienced by small establishments, OSHA calculated the ratio of their annual compliance cost to their sales and pre-tax profit for two scenarios for dealing with ETS: (1) provide designated smoking areas, or (2) totally ban smoking in the workplace. As shown in Table VI-14, for both scenarios, the average ratio of compliance costs to sales ranges from 0.44 percent to 0.52 percent. The highest impact (2.79 percent) for establishments not banning smoking would be in Personal Services (SIC-72). Estimates of compliance cost as a percentage of pre-tax profits were less than 7.05 percent for most sectors; Social Services establishments (SIC-83) would experience the largest reduction in profit (31 percent), if they allow smoking in designated rooms.

These estimates apply to the average firm in each sector. The degree to which affected firms will either incur or shift compliance costs depends largely on the competitive environment in which the establishments operate and on the elasticity of demand for the establishment's services and commodities. OSHA requests information regarding compliance costs against indicators of the demand for and the costs of the types of services and commodities provided by establishments which would be affected by the proposed standard. OSHA specifically requests comments, including empirical data regarding the demand elasticity of such establishments' patrons who will not be permitted to smoke in the presence of employees at such

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establishments. If economic feasibility is shown to be an issue for establishments such as bars and restaurants, what methods of compliance would adequately protect workers in a feasible manner?

### 3. Environmental Impact

The provisions of the standard have been reviewed in accordance with the requirements of the National Environmental Policy Act (NEPA) of 1969 [42 U.S.C. 432, et seq.], the Council on Environmental Quality (CEQ) NEPA regulations [40 CFR Part 1500], and OSHA's DOL NEPA Procedures [29 CFR Part 11]. As a result of this review, OSHA concluded that this rule will have no significant environmental impact.

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Economic Impact of the IAQ Proposed Standard on Affected Small Establishments (19 or fewer Employees)

Table VI-14  
Annual Cost Including Annual Cost without Designated Smoking Areas as a Percentage of Annual Cost with Designated Smoking Areas

	Number of Affected Small Establishments	Average Sales Per Establishment	Average Pre-Tax Profit Per Small Establishment	Average Annual Cost with Designated Smoking Areas	Average Annual Cost Per Establishment	WIO Designated Smoking Areas	Percentage Increase	Annual Cost including Annual Cost without Designated Smoking Areas as a Percentage of Annual Cost with Designated Smoking Areas
<b>AGRICULTURE, FORESTRY, FISHING</b>								
01 Agriculture Production-Crops	102,063	\$264,136	\$25,213	\$2,575	\$2,105	0.97%	10.21%	0.80%
02 Agriculture Production-Livestock	50,061	\$336,729	\$27,210	\$2,575	\$2,105	0.76%	9.48%	0.63%
03 Forestry and Wood Products	92,844	\$194,763	\$18,001	\$2,575	\$2,105	1.32%	14.30%	1.06%
04 Forestry	2,541	\$41,792	\$4,276	\$2,575	\$2,105	0.60%	5.33%	11.86%
05 Fishing	3,150	\$402,260	\$18,721	\$2,575	\$2,105	0.64%	15.40%	0.50%
06 Mining								
13 Oil and Gas Extraction	19,562	\$979,874	\$63,514	\$2,575	\$2,105	0.26%	2.75%	0.21%
<b>CONSTRUCTION</b>								
16 Building Construction - General Contractors	167,406	\$614,124	\$34,150	\$2,575	\$2,105	0.42%	6.75%	0.34%
18 Heavy Construction other than Building	32,905	\$906,344	\$57,400	\$2,575	\$2,105	0.25%	4.49%	0.21%
17 Special Trade Contractors	363,437	\$289,864	\$16,446	\$2,575	\$2,105	0.89%	13.88%	0.73%
<b>MANUFACTURING</b>								
20 Food and Kindred Products	12,715	\$2,976,976	\$145,940	\$2,575	\$2,105	0.06%	1.76%	0.07%
21 Tobacco Manufactures	62	\$264,228,342	\$40,853,837	\$2,575	\$2,105	0.0%	0.01%	1.44%
22 Textile Mill Products	3,142	\$3,081,265	\$172,738	\$2,575	\$2,105	0.08%	1.49%	0.07%
23 Apparel and Textile Products	15,739	\$685,631	\$58,846	\$2,575	\$2,105	0.27%	4.55%	0.22%
24 Lumber and Wood Products	30,198	\$550,727	\$30,318	\$2,575	\$2,105	0.47%	8.49%	0.36%
25 Furniture and Fixtures	7,358	\$654,700	\$50,079	\$2,575	\$2,105	0.30%	5.14%	0.25%
26 Paper and Allied Products	2,298	\$3,968,272	\$222,126	\$2,575	\$2,105	0.06%	1.65%	0.05%
27 Printing, Publishing & Allied Industries	53,420	\$520,012	\$38,153	\$2,575	\$2,105	0.51%	6.74%	0.42%
28 Chemicals & Allied Products	7,708	\$4,555,408	\$243,704	\$2,575	\$2,105	0.06%	1.08%	0.05%
29 Petroleum Refining and Related Industries	1,590	\$17,849,435	\$862,472	\$2,575	\$2,105	0.01%	0.20%	0.01%
30 Rubber and Miscellaneous Plastic Products	7,867	\$2,020,670	\$127,568	\$2,575	\$2,105	0.15%	2.02%	0.10%
31 Leather and Leather Products	1,282	\$1,271,811	\$77,982	\$2,575	\$2,105	0.20%	3.30%	0.17%
32 Stone, Clay, Glass, & Concrete Products	11,215	\$1,367,705	\$32,200	\$2,575	\$2,105	0.19%	3.13%	0.15%
33 Metal Industries	3,247	\$5,945,929	\$312,311	\$2,575	\$2,105	0.04%	0.62%	0.04%
34 Fabricated Metal Products	22,149	\$1,465,367	\$86,591	\$2,575	\$2,105	0.15%	2.87%	0.14%
35 Machinery, Except Electrical	40,251	\$1,788,536	\$122,571	\$2,575	\$2,105	0.14%	2.10%	0.12%
36 Electrical Machinery, Equipment & Supplies	1,626	\$2,078,637	\$117,591	\$2,575	\$2,105	0.12%	2.19%	0.10%
37 Transportation Equipment	8,008	\$2,261,219	\$77,318	\$2,575	\$2,105	0.08%	1.45%	0.06%
38 Professional & Photographic Equipment & Watches	7,112	\$2,634,370	\$174,599	\$2,575	\$2,105	0.10%	1.48%	0.08%
39 Metal, Non-Specialized Manufacturing Industries	12,681	\$500,402	\$38,415	\$2,575	\$2,105	0.51%	6.70%	0.42%
<b>TRANSPORTATION</b>								
41 Local and Interurban Transit	13,555	\$301,713	\$13,289	\$2,575	\$2,105	0.85%	19.38%	0.70%
42 Trucking and Warehousing	97,502	\$506,963	\$22,514	\$2,575	\$2,105	0.51%	11.44%	0.42%
43 Water Transportation	5,859	\$878,834	\$65,306	\$2,575	\$2,105	0.29%	3.84%	0.24%
44 Air Transportation	6,485	\$2,777,913	\$141,702	\$2,575	\$2,105	0.06%	1.82%	0.05%
45 Pipelines, Except Natural Gas	790	\$8,077,882	\$2,024,104	\$2,575	\$2,105	0.04%	0.13%	0.04%
47 Transportation Services	39,051	\$1,144,380	\$58,387	\$2,575	\$2,105	0.23%	3.71%	0.18%
48 Communications	19,603	\$2,187,022	\$361,072	\$2,575	\$2,105	0.12%	0.88%	0.10%
49 Electric, Gas, and Sanitary Services	14,752	\$1,906,360	\$207,834	\$2,575	\$2,105	0.13%	1.24%	0.11%
50 Wholesale Trade, Durables Goods	317,012	\$1,121,613	\$56,847	\$2,575	\$2,105	0.23%	4.55%	0.18%
51 Wholesale Trade, Non-Durables Goods	163,654	\$1,824,535	\$76,483	\$2,575	\$2,105	0.14%	3.37%	0.12%
52 Building Materials and Garden Supplies	60,094	\$525,197	\$24,133	\$2,575	\$2,105	0.19%	10.67%	0.40%
53 Central Merchandise Stores	19,794	\$892,220	\$46,564	\$2,575	\$2,105	0.20%	5.19%	0.24%
54 Food Stores	128,695	\$844,363	\$82,823	\$2,575	\$2,105	0.40%	11.23%	0.32%
55 Automobile Dealers and Related Products	156,327	\$723,265	\$21,917	\$2,575	\$2,105	0.36%	11.75%	0.28%
56 Apparel and Accessory Stores	111,068	\$277,582	\$22,678	\$2,575	\$2,105	0.92%	11.28%	0.76%
57 Furniture and Home Furnishing Stores	98,421	\$365,523	\$24,970	\$2,575	\$2,105	0.83%	10.31%	0.53%
58 Eating and Drinking Places	276,866	\$239,203	\$16,585	\$2,575	\$2,105	0.58%	15.53%	0.72%
59 Miscellaneous Retail Stores	281,179	\$283,371	\$18,321	\$2,575	\$2,105	0.91%	13.33%	12.80%
<b>FINANCE, INSURANCE, REAL ESTATE</b>								
60 Banking	50,543	\$1,052,910	\$194,494	NA	\$2,575	0.24%	NA	0.20%
61 Credit Agencies Other Than Banks	28,447	\$1,458,707	\$47,180	NA	\$2,575	0.15%	1.32%	1.08%
62 Security and Commodity Brokers and Dealers	32,540	\$8,078,913	NA	NA	\$2,575	0.17%	2.61%	2.29%
63 Insurance Carriers	108,303	\$478,957	\$50,864	NA	\$2,575	0.54%	NA	0.44%
64 Insurance Agents, Brokers and Service	212,400	\$452,282	\$263,420	NA	\$2,575	0.53%	NA	0.44%
65 Real Estate, Insurance, Etc.	17,911	\$2,588,073	NA	NA	\$2,575	0.10%	0.81%	0.74%
67 Holding & Other Investment Offices								
68 SERVICES								
70 Hotels and Other Lodging Places	37,838	\$418,657	\$20,871	\$2,575	\$2,105	0.82%	8.34%	0.50%
72 Personal Services	165,758	\$82,410	\$9,801	\$2,575	\$2,105	2.70%	28.27%	2.28%
73 Business Services	266,100	\$30,284	\$34,038	\$2,575	\$2,105	0.70%	7.56%	0.57%
74 Auto Repair, Services, and Garage	148,515	\$232,789	\$16,930	\$2,575	\$2,105	1.11%	15.21%	0.80%
75 Miscellaneous Repair Services	63,583	\$132,888	\$13,020	\$2,575	\$2,105	1.84%	19.78%	1.58%
76 Motion Pictures	36,015	\$38,448	\$18,549	\$2,575	\$2,105	0.85%	7.05%	0.53%
79 Amusement and Recreation, Excl. Motion Pictures	65,167	\$287,247	\$18,709	\$2,575	\$2,105	0.98%	13.07%	1.07%
80 Health Services	382,267	\$373,803	\$24,543	\$2,575	\$2,105	0.89%	10.49%	0.58%
81 Legal Services	132,808	\$234,488	\$10,580	\$2,575	\$2,105	1.10%	6.51%	0.80%
82 Educational Services	20,847	\$644,481	\$33,201	\$2,575	\$2,105	0.40%	7.78%	0.33%
83 Social Services	91,062	\$137,603	\$8,270	\$2,575	\$2,105	1.67%	31.14%	1.53%
84 Museums and Botanical and Zoological Gardens	2,238	\$189,414	\$20,634	\$2,575	\$2,105	1.38%	12.48%	1.13%
86 Membership Organizations	86,253	\$167,644	\$10,161	\$2,575	\$2,105	1.54%	25.34%	1.26%
87 Engineering, Accounting, Research & Related Serv.	221,551	\$325,644	\$12,563	\$2,575	\$2,105	0.67%	7.22%	0.55%
88 Miscellaneous Services	7,843	\$130,014	\$12,598	\$2,575	\$2,105	1.98%	20.44%	1.67%
								0.32%
								7.03%
								0.44%
								6.02%

Annual Compliance Cost is based on the following assumptions: establishment floor space = 10,000 sq ft, HVAC maintenance cost = \$0.21 per sq ft, one hour of technician time (\$15 / hr) and 15 minutes of manager time (\$30 / hr). One maintenance worker will be trained at cost of \$8,21, while annualized over 10 years at 10% interest rate. All other non-recurring costs are annualized over 10 years at 10% interest rate.

\* Non-Recurring costs for designated smoking areas are annualized over 10 years at 10% interest rate.

Source: U.S. Department of Labor, OSHA, Office of Regulatory Analysis, 1994.

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## VII. SUMMARY AND EXPLANATION

The requirements set forth in this notice are those which, based on currently available data, OSHA believes are necessary and appropriate to control conditions which may degrade indoor air and pose a significant risk of material impairment to employees in their work environments. The Agency considers that a broad approach to the control of IAQ problems, as proposed in this notice, will most effectively lead to a reduction in associated risk to employees [Exs. 3-2, 3-26, 3-37, 3-41, 3-239, 3-287, 3-434, 3-500, 3-502]. OSHA has considered all data submitted in response to the Request for Information, as well as other scientific data which has been made a part of the record in this proceeding in arriving at these proposed provisions regarding regulation of indoor air quality.

The following sections provide a summary of each provision of the proposal and a statement of their intent and purpose. Exhibit numbers included in this Summary and Explanation are citations to supporting comments and data submitted to the record in response to the RFI.

The Agency solicits data, views, and comments on all provisions proposed in this notice. OSHA is interested in whether or not the proposed provisions are necessary, appropriate, and adequate to achieve the goals of the standard and why. Interested persons should also comment on whether or not the proposed provisions are technologically and economically feasible and why, and whether additional or alternative provisions addressing indoor air quality should be included in the standard and why.

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Scope and Application: Paragraph (a)

OSHA is proposing that these standards cover all employees under its jurisdiction, including employees in general industry, shipyards, longshoring, marine terminals, construction, and agriculture. To accomplish this, OSHA is proposing to publish an identical complete standard for general industry at 29 CFR 1910.1033, for shipyards at 29 CFR 1915.1033, and for construction at 29 CFR 1926.1133. OSHA is proposing to amend section 1910.19 to make it clear that §1910.1033 is a Subpart Z standard which is incorporated by cross reference into 29 CFR parts 1917 and 1018 for longshoring and marine terminals. OSHA is proposing to amend 29 CFR 1928.21 to indicate that 1910.1033 will be applicable to agriculture. OSHA requests comments on the scope of the proposal and the formal manner by which the standard would be incorporated into the Code of Federal Regulations.

Paragraph (a)(1) proposes to apply all provisions of the standard to "nonindustrial work environments." In addition, paragraph (a)(2) proposes to further extend coverage of the provisions found in paragraph (e)(1), which address exposure to tobacco smoke, to all indoor work environments under OSHA's jurisdiction. This includes indoor work areas on construction sites, shipyards, and agricultural employments. The Agency believes that application of the proposed provisions under paragraph (e)(1) addressing exposure to tobacco smoke is necessary, appropriate, and feasible for any indoor or enclosed workplace covered by OSHA. Compliance with the tobacco smoke provisions essentially entails establishment of a separate enclosure, exhausted directly to the outside, and maintained

2503006684

under negative pressure where smoking is permitted. OSHA sees no feasibility obstacles in application of these provisions to industrial as well as nonindustrial work environments. It is not clear to OSHA, however, that the other indoor air quality provisions of the proposed standard can be feasibly or appropriately applied in typical industrial work environments. These provisions primarily address means to assure effective functioning of HVAC systems and actions felt necessary to be taken to maintain good general indoor air quality. Thus, it may not be feasible or appropriate to apply these provisions to industrial ventilation systems or industrial environments in which control of various industrial contaminant emissions rather than general air quality is the primary issue.

Definitions: Paragraph (b)

The following terms are defined for the purpose of this proposal: "Air Contaminants", "Assistant Secretary", "Building systems", "Building-related illness", "Designated person", "Designated smoking area", "Director", "Employer", "HVAC system", "Non-industrial work environment", and "Renovation and remodeling".

The term "Air contaminants" refers to substances contained in the vapors from paint, cleaning chemicals, pesticides, solvents, particulates, outdoor air pollutants and other airborne substances which may cause material impairment to the health of employees working within the nonindustrial environment. The term "air contaminants" informs the employer that the provisions addressing control of air contaminants apply to airborne

substances which may be within nonindustrial indoor work environments. For purposes of this proposal the definition of air contaminants may be broader than that used in 29 CFR 1910.1000. Hazardous levels of air contaminants may arise from contaminant buildup due to inefficient or insufficient general dilution ventilation with outside air, the misapplication of general dilution ventilation to address strong point sources, indoor activities or operations such as renovation, remodeling, maintenance, etc. which lead to local source emissions, and entry of outdoor contaminants such as vehicle exhausts, wastes, stored materials, or pollutants from adjacent industrial facilities. Provisions are proposed in the standard which require the employer to take measures to address the avenues of contaminant buildup noted above.

The term "Assistant Secretary" means the Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, or designee.

The term "Building systems" applies to the heating, ventilation and air-conditioning (HVAC) system, the potable water system, the energy management system, and all other systems in a facility which may impact indoor air quality. This broad definition was necessary to avoid excluding non-HVAC systems which do impact indoor air quality. In the facilities industry, potable hot water systems are typically considered plumbing systems and not HVAC systems. Plumbing systems (potable hot water) have been implicated in Legionella episodes where the water is aerosolized, so excluding plumbing systems from the scope of this standard would have been unacceptable. This

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definition also intends to focus operation and maintenance efforts on those systems whose failure, degradation, or misuse would adversely impact indoor air quality.

The term "Building-related illness" describes specific medical conditions of known etiology which can be documented by physical signs and laboratory findings. Such illnesses include sensory irritations when caused by known agents, respiratory allergies, nosocomial infections, asthma, humidifier fever, hypersensitivity pneumonitis, Legionnaires' disease, and the symptoms and signs characteristic of exposure to chemical or biologic substances such as carbon monoxide, formaldehyde, chlordane, endotoxins, or mycotoxins. "Building-related illness" defines the medical conditions that, if observed, require evaluation of the facility building systems to determine if they are functioning properly, and the taking of remedial action where warranted. Building-related illnesses are often potentially severe and are often traceable to a specific contaminant source such as ETS, microbial growth, and a host of other chemical or biologic substances which must be attended to mitigate degradation of indoor air quality.

The term "Designated person" means a person who has been given the responsibility by the employer to take necessary measures to assure compliance with this section and who is knowledgeable in the requirements of this standard and the specific HVAC system servicing the affected building or office. As noted above a "Designated person" must be knowledgeable in HVAC system functioning. Provisions in the standard propose to require the "Designated person" to oversee the establishment and

2503006687

implementation of the IAQ compliance program, and oversee building systems inspection and maintenance activities, thus this person must have technical expertise in those areas. OSHA believes that there is a need for central responsibility in affected buildings and facilities [Exs. 3-434, 3-444b, 3-507]. Of course OSHA recognizes that in certain circumstances the "Designated person" may merely supervise or coordinate the activities of outside contractors or shift-workers who have responsibility for maintaining parts of the building systems. Building systems and other factors affecting indoor air quality are sufficiently complex and unique to suggest the necessity of appointing a designated person who is on site to act on the employers behalf in this regard. For example, multiple employers may be engaging in different activities within a facility that affect building system functioning or air quality and actions by one employer may subject employees of other employers to environmental hazards. Fragmentation of responsibility and lack of communication has been observed by OSHA in the nonindustrial workplace. For example, when responding to an indoor air quality/building-related illness complaint, the OSHA Compliance Officer may need to gather information from a number of responsible facility groups like tenant leasing, facilities engineering, housekeeping, maintenance, operations, and energy management. These diverse groups may have little or no central authority and direction especially if they are outside contractors. The designated person would be in a position to mitigate the consequences of such diversity by being aware and

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responsible for the overall environmental conditions in the building or facility.

Other OSHA health standards have adopted similar requirements with respect to those proposed in this Notice regarding the designated person. For example, final standards for chromium (57 FR 42102) and lead (58 FR 26590) require that a technically knowledgeable "competent person" be on site during construction activities, which often involve multiple employers. OSHA concluded in those standards that designating a person to act on the employers behalf to ensure compliance with various provisions of those standards, was necessary because of the need for continual site characterization and analysis to identify the hazards present and the types of control measures and remedial actions that are effective. For these same reasons, OSHA proposes requirements for designated persons under this notice.

The term "Designated smoking area" means a room in which smoking of tobacco products is permitted. The Agency believes that establishment of "designated smoking areas" is necessary to prevent employee exposure to ETS in workplaces where smoking is not prohibited. Provisions are included in this proposal addressing design, construction and operation of such areas to meet this purpose.

The term "Director" means the Director, National Institute for Occupational Safety and Health (NIOSH) U.S. Department of Health and Human Services, or designee.

The term "Employer" means all persons defined as employers by Sec. 3(5) of the Occupational Safety and Health Act of 1970 including employers (such as building owners or lessees) who

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control the ventilation or maintenance of premises where employees of other employers work. For purposes of the proposal, an employer is also defined as a person who exercises control over the ventilation systems in the workplace. Control over the ventilation systems is a multi-faceted concept: it includes maintenance, recordkeeping and the development and implementation of the indoor air quality compliance plan. While responsibility for various aspects of the ventilation system encompasses many duties, the proposal does not necessarily contemplate that all of the duties will be performed by the same person. The proposal is flexible in that regard and responsibility for the various aspects can be shared by various persons depending on the circumstances.

In many instances the employer will either be the owner of the building where the workplace is located or will be a long term lessee, responsible under the lease for the care and maintenance of the property. In these cases, the owner/employer would take care of the ventilation system by designating knowledgeable persons within his employ to the necessary tasks or by hiring competent contractors.

In other cases, there will be a number of different businesses all located in separate leased space within the same building. In these instances the various employer/lessees would probably share responsibility for compliance with the proposed standard. For example, each individual lessee might be obligated to provide the building owner with a description of the work activity planned for within its particular leased space, including the number of employees or visitors expected, the hours

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of work operation and any situations where air contaminants may be released into the workplace air. Air contaminants might reasonably be expected to be released into the workplace air as a result of the installation of new furniture or wall coverings, any painting or remodeling scheduled to take place or any pest extermination activity within the premises. Each employer would, of course, be responsible for reporting to whoever is in charge of the ventilation system, any employee complaints or signs or symptoms that may be related to building-related illness.

The building owners or whoever is in charge of the maintenance of the ventilation system would be in a position to develop standard operating procedures for the building systems as well as special procedures for emergencies and maintenance. In addition such a person would be in a position to know or develop an appropriate maintenance schedule and to gather relevant documents to assist in the care and maintenance of the ventilation system, such as diagrams of the system, manufacturers manuals, and inspection guidelines and schedules for the proper maintenance of such systems. The same person might also be responsible for maintaining and operating the HVAC system to provide the required air ventilation rate and desired relative humidity.

The proposal is designed in this performance oriented manner to afford affected employers the flexibility to assure the establishment and maintenance of a system to provide healthful indoor air quality in the most sensible and efficient way possible considering their particular circumstances.

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The Occupational Safety and Health Act gives the Secretary the right to promulgate standards to assure employees safe and healthful working conditions. Employers must comply with the standards which the Secretary promulgates. The Act defines an employer expansively as a person with employees in a business affecting interstate commerce.

The Agency believes that the proposal as written will protect employees from the risks of poor indoor air quality. Where the owner of a business is not the owner of the space where such business operates, the owner or landlord of the building will probably also be an employer within the meaning of the Act and the definition contained in this proposal. This is so because the building owner or operator will generally have employees (either on site or off site) and will be engaged in a business affecting interstate commerce. In such cases the situation will be construed to be a multi-employer worksite. Such situations are quite common in the context of construction sites. The Agency does not believe that there is any reason to treat nonindustrial multi-employer worksites differently from construction multi-employer worksites for purposes of compliance.

OSHA has a long history of enforcing OSHA standards in multi-employer worksites. Nothing in this proposed rule would change the position that the Agency has taken in cases such as Anning-Johnson (4 OSH Cas. (BNA) 1193, Harvey Workover, Inc., 7 OSH Cas. (BNA) 1687 and in its Field Operations Manual (CPL 2.45 CH-1, Chapter V-9). As a general matter each employer is responsible for the health and safety of his/her own employees. However, under certain circumstances an employer may be cited for

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endangering the safety or health of another employer's employees. In determining who to hold responsible, OSHA will look at who created the hazard, who controlled the hazard, and whether all reasonable means were taken to deal with the hazard.

It is contemplated that in those cases where there is a multi-employer worksite that the affected employers will divide up the responsibilities in the manner in which they make the most sense. Those who have information at their disposal that is required to be kept under the proposal will make use of the information or make it available to whoever will need that information in the discharge of their duties. For example, the building engineer may have possession of the schematics of the ventilation system. The engineer would make them available to the person responsible for maintaining the system as well as the person responsible for developing the IAQ Compliance Plan (if that is not the same person). The proposal is designed to promote the efficient resolution of indoor air quality problems and will not result in duplicative efforts. There is nothing in the proposal, for example, that would prevent the building owner (who is an employer within the meaning of the Act) from gathering the required information from the various lessee/employers in the premises, developing, and implementing an IAQ Compliance Plan which would be shared with the various employers occupying the premises. In addition, it may be more efficient for the building owner to develop and maintain the records required by the proposal, again sharing them with the various employer-tenants. The Agency believes that the co-operative interrelationships which the performance oriented proposal permits will avoid

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duplication of compliance activities even within multi-employer worksites.

The term "HVAC system" means the collective components of the heating, ventilation and air-conditioning system including, but not limited to, filters and frames, cooling coil condensate drip pans and drainage piping, outside air dampers and actuators, humidifiers, air distribution ductwork, automatic temperature controls, and cooling towers. This definition also intends to focus on those HVAC system components whose failure, degradation, or misuse would adversely impact indoor air quality.

The term "Nonindustrial work environment" means an indoor or enclosed work space such as, but not limited to, offices, educational facilities, commercial establishments, and healthcare facilities, and office areas, cafeterias, and break rooms located in manufacturing or production facilities. Nonindustrial work environments do not include manufacturing and production facilities, residences, vehicles, and agricultural operations.

The term "Renovation and remodeling" means building modification involving activities that include but are not limited to: removal or replacement of walls, ceilings, floors, carpet, and components such as moldings, cabinets, doors, and windows; painting, decorating, demolition, surface refinishing, and removal or cleaning of ventilation ducts.

The terms "HVAC system", "Nonindustrial work environment", and "Renovation and remodeling" are defined to clarify and illustrate the parameters under which obligations of the standard are incurred. For example, the definition of "HVAC system" lists what OSHA believes to be typical components of such systems which

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directly affect indoor air quality. These components are enumerated since provisions under the standard propose to require employers to perform routine inspection and maintenance on those components. "Renovation and remodeling" is defined to inform the employer of the situations under which the standard proposes to require the employer to take special precautions when those activities take place.

Indoor air quality compliance program: Paragraph (c)

This paragraph proposes to require employers to obtain or develop certain written information that will facilitate implementation of measures necessary to prevent degradation of indoor air quality. Paragraph (c) (2) proposes to require the employer to identify a designated person to be given the responsibility of overseeing establishment and implementation of the written compliance program. Paragraph (c) (3) proposes to require the employer to establish a written IAQ compliance program to include at least the following information: a description of the facility building systems; schematics or construction documents locating building systems equipment; information on the daily operation and management of the building systems; a description of the building and its function; a written maintenance program; and a checklist for visual inspection of the building systems. Further, paragraph (c) (4) proposes to require that the following information also must be retained, if available, to assist in indoor air quality evaluations: as built construction documents; HVAC system commissioning reports; HVAC system testing, adjusting and

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balancing reports; operation and maintenance manuals; water treatment logs; and operator training materials. Paragraph (c) (5) proposes to require the establishment of records of employee complaints of building-related illnesses, as part of the written program.

OSHA believes that written plans are an essential element of an overall compliance program since it will encourage employers to focus on indoor air quality and implement the necessary controls and measures to achieve compliance with the standard [Exs. 3-38, 3-85, 3-412, 3-434, 3-500, 3-502, 3-505, 3-529]. The development of documented safety and health programs and procedures is a well-established and common practice in industry, and requirements for written programs are typically found in other OSHA standards dealing with exposure to toxic substances. Written plans provide information to allow OSHA, the employer, and employees to examine the control methods chosen and evaluate the extent to which these planned controls are being implemented.

Paragraph (c) (3) proposes to require the employer to establish written plans for compliance. Specifically, paragraphs (c) (3) (i), (c) (3) (ii), and (c) (3) (iii) propose to require general, descriptive information about: the facility, building systems, building function and building use patterns. This general building description is believed to be essential information of a building profile which is necessary for a basic understanding of the building systems and which is necessary to set the foundation for the operations and maintenance information required in other paragraphs.

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Further, in paragraph (c) (3) (iv), OSHA believes that it is necessary to require written information which describes daily operation and management of the facility building systems which directly affects IAQ. When it comes to operations and management, organizational fragmentation within nonindustrial buildings may be further exacerbated by the lack of familiarity with the intent of the original design team whose assumptions and design intent for the HVAC system, are typically unknown. Over time, building use may differ from original design intent in ways not foreseen by the original designers. It is not uncommon for spaces to be loaded or used in ways beyond the original design intent which may adversely impact IAQ, such as putting up walls for private offices, exceeding intended occupant densities, and bringing into the space new contaminant sources. HVAC system total capacity may be able to handle these changes from original design loads but little is done to balance the available capacity among the individual zones that may be overused or underused.

In addition, the employer may need to communicate design intent and performance criteria to building occupants whose expectations regarding their environment may exceed what is deliverable by the building systems.

To address these issues, OSHA is proposing to require that each facility have written operations and management information whose aim is twofold. One purpose is to collect, summarize and translate design assumptions and intent into operating performance criteria that impact IAQ, such as minimum outside air ventilation rates and occupant densities.

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Secondly, the operations information should describe how to operate and manage the building systems so that they perform in conformance with the reported criteria. This written operations and management information replaces verbal communications and provides a training document whenever new personnel or new contractors are introduced to the site. Operating information should formally reflect changes in control strategies that typically occur in facilities to accommodate change in use or energy conservation efforts. This is an essential element because of the interdependence between outside air ventilation rate and the automatic temperature control system. In almost all buildings the performance of the ventilation system is affected by space temperature control needs.

Paragraph (c) (3) (v) proposes to require a written maintenance program for those building system components that directly affect IAQ because failure to do so may result in the degradation of IAQ in the facility. A written maintenance program is believed to be necessary because levels of HVAC system maintenance vary dramatically and sometimes are deficient where untrained personnel are designated to maintain very complex systems. The following are examples of maintenance deficiencies which have been associated with IAQ problems: plugged drains on cooling coil condensate drip pans resulting in microbial contamination of pan; failed exhaust fans in underground parking garages which allow carbon monoxide to infiltrate into the building above; microbial fouling of cooling tower water from lack of water treatment with biocides resulting in legionellosis

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cases; and failure of automatic temperature control system resulting in lack of outside ventilation air.

Maintenance of HVAC equipment, for example, may include simple housekeeping of equipment and air transport pathways, lube and adjustment programs for rotating machinery, and catastrophic failure maintenance to repair/replace failed equipment. There appears to be consensus among HVAC maintenance personnel that the most successful maintenance programs, gauged in terms of system performance and life-cycle economics, are proactive rather than reactive. Consequently, OSHA is promoting preventive maintenance programs for those building system components which affect IAQ. At a minimum, the maintenance program should describe the equipment to be maintained, establish maintenance procedures and frequency of performance.

Paragraph (c) (3) (vi) proposes to require a checklist to guide periodic inspections of building systems. This checklist should focus on those building system components whose failure, degradation, or misuse would adversely impact indoor air quality. The checklist shall include but not be limited to inspection of the following components and performance criteria: fibrous liner used for acoustics and insulation in airhandlers and ducts should be inspected for erosion and moisture; smoke-trails testing should be performed to verify design pressurization schemes like negative pressure smoking rooms; ceiling, floor and wall surfaces should be examined for signs of water leaks which could support and amplify microbial contamination; and outside air louvers, intake paths, dampers, actuators, and linkages should be checked for obstruction.

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Paragraph (c) (5) proposes to require the establishment of records of employee complaints of building-related illnesses as part of the written program. These records are believed to be necessary to expedite review and evaluation of the system and to support implementation and operation of an adequate IAQ program [Exs. 3-434, 3-444b, 3-502].

The Agency believes that effective system operation and maintenance will necessarily rely upon written information and records such as those relating to design expectations, system capacities, code requirements, maintenance activities and system evaluations. As with other OSHA rulemakings, the written compliance plan is to be accessible to employees.

Compliance program implementation: Paragraph (d)

This paragraph proposes to require that the employer take certain actions to maintain acceptable indoor air quality. These actions primarily address means that OSHA believes necessary to achieve continued adequate and proper functioning of building systems [Exs. 3-10, 3-17, 3-26, 3-38, 3-41, 3-55, 3-56, 3-61, 3-85, 3-329, 3-364, 3-412, 3-415, 3-434, 3-436, 3-444A, 3-479, 3-496, 3-500, 3-501, 3-502, 3-505, 3-507, 3-529, 3-531].

Paragraph (d) (1) proposes to require that employers maintain and operate the HVAC system to provide at least the minimum outdoor air ventilation rate, based on actual occupancy, required by the applicable building code, mechanical code, or ventilation code in effect at the time the facility was constructed, renovated, or remodelled, whichever was most recent [Ex. 3-18]. Paragraph (d) (2) proposes to require employers to conduct

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building system inspection and necessary maintenance activities as often as necessary to reduce the likelihood of indoor air quality problems related to the building systems [Ex. 3-26]. Further requirements under paragraph (d) are: assure that the HVAC system is operable during all work shifts, (d)(3) [Exs. 3-56, 3-226, 3-347, 3-436]; implement the use of general or local ventilation where maintenance activities may result in hazardous chemical or particulate exposures in other areas of the building, (d)(4) [Exs. 3-347, 3-502]; maintain relative humidity below 60% in buildings with mechanical cooling systems, (d)(5) [Exs. 3-34, 3-61, 3-505B]; during regular maintenance, as described in subparagraph (d)(1), measure carbon dioxide levels. When they exceed 800 ppm, check to make sure the HVAC system is operating as it should and correct deficiencies if necessary, (d)(6) [Exs. 3-10, 3-34, 3-214]; assure that buildings without mechanical ventilation are maintained so that windows, doors, vents, etc., designed or used for natural ventilation are in operable condition, (d)(7); assure that mechanical equipment rooms and any non-ducted air plenums or chases are maintained in a clean condition, free of hazardous substances, and asbestos, if friable, is encapsulated or removed so that it does not enter the air distribution system, (d)(8) [Exs. 3-29, 3-500]; assure that inspections and maintenance of the HVAC system are performed by or under the direction of the designated person, (d)(9) [Ex. 3-29]; establish a record of HVAC system inspections and maintenance, (d)(10) [Ex. 3-26]; assure that employees performing work on HVAC systems are provided with and use appropriate personal protective equipment, (d)(11) [Ex. 3-56]; evaluate the

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need to perform alterations of the HVAC system in response to employee reports of building-related illness, (d)(12); and take such remedial measures as the evaluation shows to be necessary, (d)(13).

OSHA believes that implementation of each of the actions prescribed in this proposed paragraph are integral elements in the indoor air quality program. Provisions which address inspection, maintenance, alteration, and operation of building systems are believed to be essential to ensure successful functioning of system functioning.

Paragraph (d)(1) proposes to require that employers operate and maintain the HVAC system to provide at least the minimum outside air ventilation rate. Available evidence in the literature supports this requirement. The literature which supports the case for ventilation with outside air falls into two categories. One category includes case studies which are generated when IAQ complaints require on-site responses and the investigators report their findings through IAQ forums sponsored by professional organizations like the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. and the American Industrial Hygiene Association. These studies report that the lack of outside ventilation air resulting from operational or maintenance deficiencies as one of the causes of IAQ complaints. Many of the studies include abatement recommendations to ventilate with outside air as feasible per the original design intent. The second category includes research projects which also support the case for ventilating buildings with at least the recommended minimum of outside air. Research

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in the areas of ventilation efficiency, tracer gas analysis, dilution/removal of internally generated contaminants, and environmental perceptions mostly support this contention.

All three major building codes in the United States which are used in the design of new and retrofitted facilities mandate minimum outside air ventilation rates in mechanically-ventilated buildings. These three code bodies include the Building Officials and Code Administrators International, Inc. (BOCA), the International Conference of Building Officials (ICBO), and the Southern Building Code Congress International, Inc. (SBCCI). Per Section 102 of the 1991 Uniform Building Code as promulgated by the ICBO, the purpose of the building code is "to offer minimum standards to safeguard life or limb, health, property, and public welfare by regulating and controlling the design, construction, quality of materials, use and occupancy...". Clearly, there is a significant commitment of resources by these code bodies to offer design guidance through the building codes to designers to insure that a facility is capable of delivering a minimum amount of outside air to its' occupants. This concept is supported by the efforts of plan reviewers and building inspectors in local governmental jurisdictions throughout the United States who ensure that facilities are constructed per the building codes. Considering the up-front efforts of these code officials, designers, and construction teams, it is reasonable from a standpoint of continuity, to require that buildings be operated and maintained to the same design intent.

This provision is not meant to require rebuilding or retrofitting HVAC systems in response to minor work. For

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example, such steps would not be required for any renovation work that does not modify the building's configuration or the conditions that would be affected by the building code applicable at the time the system was installed or last modified.

As part of maintenance, there should be a predictive element which periodically checks the HVAC system to evaluate conformance with paragraph (d). This check should conform with the proposals of paragraph (d)(2) which requires an inspection and maintenance of the building systems. This periodic visual inspection is focused by the checklist outlined in paragraph (c) and targets those components that directly impact indoor air quality. In the field of occupational safety and health, as practiced by industrial hygienists, it is common practice to perform walk-around inspections. On the other hand, the HVAC industry often relies heavily on remote sensing to characterize system performance. Therefore, this required visual inspection will help identify those deficiencies that would otherwise be missed, such as microbial contamination in cooling coil condensate drip pans.

Paragraph (d)(3) requires that the facility HVAC system is operating during all workshifts. The employer must provide the minimum outside ventilation rate for contaminant dilution and removal whenever the building is occupied and used. OSHA understands that the minimum outside air ventilation rate may in practice only be provided when the building is fully occupied or utilized. It is not uncommon for office buildings to be occupied from 6:00 AM to 7:00 PM to accommodate flexible work schedules but the HVAC system may only be in operation from 8:00 AM to 5:00

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PM to conserve energy. The technical rationale for this strategy is typically based on the recommendations of the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE) in their Standard 62-1989 titled "Ventilation for Acceptable Indoor Air Quality". Section 6.1.3.4 and Appendix "G" of ASHRAE Standard 62-1989 [Ex. 4-333] offers a rationale for the lead/lag operation of ventilation systems to accommodate transient occupancy. The basis for the rationale is that there is capacity in air to dilute contaminants if the space has been previously unoccupied for several hours. This strategy, however, applies only to occupant generated contaminants like carbon dioxide and odors. Housekeeping cleaning agents or pesticides are typical of contaminants that may be released which could not be absorbed by a non-ventilated space. Consequently, other contaminants must be diluted/removed by the ventilation system whenever the building is occupied. In addition, it is recognized that certain automatic temperature control strategies can also prevent a facility from receiving the minimum outside air ventilation rate. The obvious example is the early morning warm-up cycle wherein the outside air dampers are kept shut in the morning until the space temperature recovers from the setback temperature of the night before. These energy conservation and temperature control strategies must not interfere with providing minimum outside air ventilation when the building is occupied.

Paragraph (d) (4) proposes to require the employer to utilize general or local exhaust ventilation, as provided by the existing HVAC system or auxiliary systems, to minimize the hazards associated with maintenance or housekeeping activities. The

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literature reports IAQ/BRI episodes that were initiated with activities like painting, carpet cleaning and floor resurfacing. If these activities occur during unoccupied periods then chemical vapors from paints and adhesives and excessive moisture from carpet cleaning may be diluted and removed by the outside air ventilation function of the HVAC system. During occupied periods, efforts should be made to restrict transportation of hazardous contaminants from these activities throughout the facility by the HVAC air distribution system.

Paragraph (d) (5) proposes to require the employer to maintain occupied space relative humidities below 60% in buildings with mechanical cooling systems. Moisture in a building may support and amplify microbial contamination with potential for aerosolization. Both the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE) in their Standard 62-1989 titled "Ventilation for Acceptable Indoor Air Quality", section 5.11 [Ex. 4-333] and the American Conference of Governmental Industrial Hygienists (ACGIH) in their 1989 "Guidelines for the Assessment of Bioaerosols in the Indoor Environment" [Ex. 3-61] recommend that relative humidity in the occupied space be maintained below 60%.

OSHA is inviting comments on whether a relative humidity of 60% is the appropriate upper limit to inhibit microbial growth or if a higher limit is appropriate. In addition, OSHA would like comment on whether there should be a lower level of relative humidity as recommended by ASHRAE and ACGIH to reduce irritation effects due to low relative humidity. And finally, OSHA would

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like additional comment on whether it is feasible in hot and humid climates to achieve relative humidities of 60% or less.

Paragraph (d) (6) proposes to require the employer to monitor for carbon dioxide ( $\text{CO}_2$ ) in the occupied space as part of maintenance or employee complaint investigations. When the concentration exceeds 800 ppm, the employer would be required to check the operation of the HVAC system.  $\text{CO}_2$  is frequently used as a gross surrogate indicator of indoor air quality. Ideally, by knowing the rate of accumulation of  $\text{CO}_2$  in the space and the rate of generation of  $\text{CO}_2$  by respiring occupants in the space, it would be possible to predict the rate of removal of  $\text{CO}_2$  from the space by the HVAC system. Because buildings have average occupant densities to generate  $\text{CO}_2$ , the concentration is an indicator of the HVAC system's ability to dilute and remove occupant generated contaminants like  $\text{CO}_2$ , water vapor, and odors (human bioeffluents). However, the  $\text{CO}_2$  concentration and the associated outside air ventilation rate offers no confidence as to the adequacy of dilution and removal of other contaminants released in the space. If the outside air ventilation rate is insufficient to dilute and remove  $\text{CO}_2$ , then it can be assumed that other contaminant concentrations will also be elevated. The literature reports that  $\text{CO}_2$  concentrations in the space under 800 ppm will minimize health-related complaints [Exs. 3-34A, 4-331].

Paragraph (d) (8) proposes to require the employer to restrict the presence of hazardous substances in air distribution systems. The HVAC air distribution system itself should not be the source of hazardous contaminants due to its' critical nature as a potential pathway to building occupants. Enclosed ducts are

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typically not used to store hazardous substances but non-ducted air transport pathways such as area-ways, plenums, chases, corridors, and mechanical rooms serving as return air plenums are sometimes used for storage. If these air transport pathways are used for storage, then the employer must be especially careful to make sure that no spillage or leakage of hazardous substances occurs. This will insure that the pathways are kept free of hazardous substances.

Paragraph (d) (11) proposes to require that employees working on building systems are provided with and use personal protective equipment (PPE) as required by other OSHA standards including; 29 CFR 1926, Subpart E, Personal Protective and Life Saving Equipment; 29 CFR 1926.52, Occupational Noise Exposure; 29 CFR 1910, Subpart I, Personal Protective Equipment; and 29 CFR 1910.95 Occupational Noise Exposure.

OSHA is aware, through its experience and through the literature and submissions to the docket, that HVAC Operations and Maintenance (O&M) personnel may often receive minimal training regarding existing relevant OSHA regulations and the hazards that they are exposed to in the performance of their duties. Sometimes, facilities are not viewed as industrial workplaces by either the management or employees. However, the hazards do exist and therefore compliance with existing regulations is necessary to protect the health and safety of O&M employees. Respirators may not normally be used in this industry due to the perceived lack of a substance-specific hazard. But situations may occur, for instance, such as chemical

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or microbial contamination, that would require compliance with 1910.134.

Other provisions of this section require; that buildings without mechanical ventilation be operated and maintained to provide natural ventilation; that inspections and maintenance of building systems be performed by or under the supervision of the designated person; that the employer establish a written record of building system inspections and maintenance required under this section; that the employer evaluate the need to perform modifications to the building systems to meet the minimum requirements specified in paragraph (d) of this section in response to employee complaints of building-related illnesses.

Controls for specific contaminant sources: Paragraph (e)

This paragraph proposes to require employers to take specific protective measures to control employee exposure to specific agents such as tobacco smoke [Exs. 3-7, 3-10, 3-85, 3-291, 3-305, 3-409, 3-449, 3-496, 3-505B], outdoor pollutants [Ex. 3-496, 3-500, 3-502, 3-505], contaminant emissions from local indoor sources [Exs. 3-10, 3-17, 3-26, 3-38, 3-412], microbial contaminants [Exs. 3-10, 3-26, 3-61, 3-496, 3-500, 3-502, 3-505, 3-506], hazardous chemicals including cleaning and maintenance chemicals and pesticides [Exs. 3-56, 3-436, 3-496, 3-500, 3-505].

With respect to tobacco smoke in workplaces where smoking is not prohibited, paragraph (e)(1) proposes to require the establishment of designated smoking areas. Such areas must be enclosed and exhausted directly to the outside, and maintained

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under negative pressure sufficient to contain tobacco smoke within the designated area. Smoking is not permitted during cleaning and maintenance work in these designated smoking areas. Moreover, although cleaning and maintenance are specified in this paragraph, it is OSHA's intent that no work of any kind shall be performed in a designated smoking area when smoking is taking place. Designated smoking areas must be areas where employees do not have to enter in the performance of normal work activities. Signs must also be posted at designated smoking areas. Signs must be posted to inform anyone entering the building that smoking is restricted to designated areas. Finally, smoking within designated areas, is not permitted during any time that the exhaust ventilation system servicing that area is not operating properly.

The proposed provisions under paragraph (e)(1) addressing control of tobacco smoke are intended to ensure that employees outside of the designated smoking area will not be exposed to ETS. The Agency anticipates that the provisions as proposed will accomplish that goal. Enclosing smoking areas, exhausting them to the outside, maintaining them under negative pressure, and prohibiting smoking in designated areas even when the exhaust system is inoperable are believed to be necessary and sufficient to prevent tobacco smoke from migrating to other areas of the building.

The designated smoking area must be under negative pressure compared to all surrounding spaces including adjoining rooms, corridors, plenums and chases. Negative pressure is achieved by exhausting more air from the space than is supplied to the space.

Transfer air must enter the designated smoking room to make-up the volumetric flowrate differential between supply and exhaust air. It may be necessary to provide a tight architectural enclosure so as to achieve negative pressure and containment. Leakage through a lay-in ceiling tile system may occur if there is a return air plenum above it. Negative pressure will induce airflow into the room through the entrance door undercut. Containment may be checked by using smoke-trails at the door undercut to verify direction of airflow.

Contaminated exhaust air from a designated smoking room must be transported to the outside through exhaust ducts under negative pressure to avoid duct leakage into nonsmoking areas that the duct passes through.

The provisions regarding posting of signs are intended to prevent inadvertent entry into smoking areas, and inadvertent smoking in areas other than designated smoking areas. To prevent involuntary exposure, designated smoking areas cannot be areas where employees perform normal work activities. For the same reason, smoking is not permitted in smoking areas during performance of work activities such as cleaning and maintenance of the designated smoking area.

This provision will have special impact on establishments such as bars and restaurants. OSHA invites comments on feasibility considerations relative to such establishments and suggestions for alternative ways to assure that nonsmoking workers will not be exposed to tobacco smoke there.

Proposed paragraph (e)(2) establishes requirements dealing with outdoor air pollutants and contaminants emitted locally

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within workspaces. This paragraph proposes to require the employer to implement measures to restrict the entry of outdoor air pollutants into the building and to control local indoor sources of air contaminant emissions by employing other control measures like substitution or local source capture exhaust ventilation.

Proposed paragraph (e) (3) proposes to require the control of microbial contamination by routinely inspecting for and repairing water leaks that can promote growth of biologic agents, by promptly drying, replacing, removing, or cleaning damp or wet materials; and by taking measures to remove visible microbial contamination in ductwork, humidifiers, other HVAC system components, or on other building surfaces.

Proposed paragraph (e) (4) addresses the use of cleaning and maintenance chemicals, pesticides and other hazardous chemicals. Pesticides must be used according to manufacturers' recommendations, and where chemicals are to be used, employees in those areas affected are to be informed, at least within 24 hours prior to use, of the type of chemical to be applied.

The provisions proposed under (e) (2) are intended to ensure that indoor air quality is not degraded as a result of entry of outdoor contaminants, such as vehicle exhaust, or by circulation of contaminants generated within the building. The Agency believes that, where necessary, entry of outdoor air pollutants can be restricted by eliminating or repositioning entry points into the building.

Indoor local contaminant emissions can be minimized where necessary, through application of control measures such as source

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substitution and engineering controls that may include local source capture exhaust ventilation. Collection of contaminants at their source of emission through engineering controls is an accepted basic principle of industrial hygiene. Equipment and processes which are located or take place in areas that may lead to contamination of other areas should be provided with engineering controls, where necessary and feasible.

The provisions proposed in paragraph (e)(3) are intended to limit the opportunity for microbiological contamination of building systems and structures. Although individual microbes are not visible to the naked eye, colonies of microbes are. Moisture can lead to microbiological growth in indoor spaces, within HVAC systems, or within building structures, and thus to a variety of detrimental health effects. The employer therefore, is required to take preventive and corrective actions to minimize microbiological growth. Preventive action includes routine inspection for biological growth, with required corrective actions such as repairing water leaks, drying, replacing, or cleaning wet materials, and removal of visible microbiological growth [Exs. 3-61, 3-502].

The provisions proposed in paragraph (e)(4) are intended to restrict indoor exposure to hazardous substances such as pesticides and chemicals used for cleaning and maintenance purposes. The Agency believes that proper use of such substances is important to limit incidental exposures to those performing cleaning and maintenance as well as to other employees who might be incidentally exposed. Manufacturers recommendations for use of these products often address aspects of ventilation, employee

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protection, occupancy limitations, and other protective measures. Thus, the Agency has proposed to require that chemicals covered under this paragraph must be used in accordance with manufacturer's recommendations. To further limit the potential for incidental exposures to these chemicals the standard proposes to require that employees in areas to be treated by such chemicals are to be notified within at least 24 hours prior to their application.

Air quality during renovation and remodeling: Paragraph (f)

Paragraph (f) (1) proposes to require implementation of specific procedures to minimize degradation of air quality during renovation and remodeling activities [Exs. 3-26, 3-38, 3-444B].

Paragraph (f) (2) proposes to require development and implementation of a work plan to restrict entry of air contaminants into other work areas during remodeling, renovation, and similar activities [Ex. 3-444b]. Where appropriate, elements of the workplan to be considered are requirements of this standard, implementation of means to assure that HVAC systems continue to function effectively during remodeling and renovation activities, isolation or containment of work areas and appropriate negative pressure containment, air contaminant suppression controls or auxiliary air filtration, and controls to prevent air contaminant entry into HVAC systems. Finally, paragraph (e) (3), proposes to require 24 hour advance notification of employees, or promptly in emergency situations, of work to be performed on the building that may introduce air contaminants into their work area. Such notification must

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include anticipated adverse impacts on indoor air quality or workplace conditions.

The provisions under proposed paragraphs (f)(1) and (f)(2) are intended to ensure that renovation, remodeling and similar activities are performed in a manner that will reduce the potential for air contaminants generated during those activities from entering other areas of the building. Such activities which may involve demolition, sanding, surface refinishing, component removal and replacement, etc. can result in hazardous substance emission from solvents, paints, carpets, etc. and can also produce high levels of particulate contamination. To control such emissions, the standard proposes to require employers to develop a workplan for the implementation of appropriate work procedures and controls such as exhaust ventilation, isolation, containment, or use of wet methods during renovation and remodeling activities.

Finally, paragraph (f)(3) proposes to require notification of employees in the vicinity of renovation and remodeling activities who may be subject to incidental exposure to emissions produced during such activities [Ex. 3-444B]. This notification must also apprise affected employees of the potential adverse impact on air quality. Informing employees of potential workplace hazards is felt by the Agency to be imperative for the success of any safety and health program. OSHA believes that employees can do much to protect themselves if they are informed of the nature of the hazards to which they are exposed.

Employee information and training: Paragraph (g)

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Paragraph (g) proposes to require employers to provide special training for workers involved in maintenance activities and those involved in HVAC system operations, and to provide certain pertinent information to all employees.

Paragraph (g)(1) proposes to require that maintenance and HVAC operations personnel be trained in the use of personal protective equipment (PPE) required to be worn; training on how to maintain adequate ventilation of exhaust fumes during building cleaning and maintenance; and training of maintenance personnel on how to minimize adverse effects on indoor air quality during the use and disposal of chemicals and other agents [Exs. 3-26, 3-38, 3-41, 3-347, 3-415, 3-434, 3-440, 3-444B, 3-500, 3-502].

Paragraph (g)(2) proposes to require that all employees shall be informed of the contents of the standard and its appendices, signs and symptoms associated with building-related illness, and the requirement under proposed subparagraphs (d)(12) and (d)(13) which directs the employer to evaluate the effectiveness of the building systems, if necessary, upon receipt of complaints from employees of building-related illness [Exs. 3-38, 3-347, 3-412, 3-415, 3-434, 3-444B, 3-500, 3-529]. The information proposed to be provided under this subparagraph need not be conveyed to employees through formal training sessions or courses. Informing employees can be accomplished, for example, through written means such as fact sheets, memos, or posted bulletins. OSHA will provide in a non-mandatory appendix to the final rule an example illustrating what information is to be provided to employees.

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Paragraph (g) (3) proposes to require that the employer make training materials developed under these provisions, including the standard and its appendices, available for inspection and copying by employees, designated employee representatives, the Director, and the Assistant Secretary.

Training and information requirements are routine components of OSHA health standards. The inclusion of training and information requirements reflects the Agency's conviction, as noted above, that informed employees are essential to the operation of any effective health program. OSHA believes that informing and training employees about the hazards to which they are exposed will contribute substantially to reducing the incidence of diseases caused by workplace conditions. Further, as noted earlier, it has been OSHA's experience that unacceptable indoor air quality is often the result of deficiencies in implementing effective HVAC system operation and maintenance programs. The Agency believes that specialized training of workers performing those activities is, therefore, necessary to ensure successful performance of their jobs.

Recordkeeping: Paragraph(h)

Paragraph (h) proposes to require that employers maintain records of: all written information regarding the IAQ compliance program required to be established under paragraph (c); inspection and maintenance records required to be established under paragraph (d) [Ex. 3-26], which must include the specific remedial or maintenance actions taken, the name and affiliation of the individual performing the work, and the date of the

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inspection or maintenance activity; and records of employee complaints of building-related illness required to be established under paragraph (c) (5) of this section [Ex. 3-502].

Paragraph (h) also proposes to require the employer to retain these for at least the previous three years [Ex. 3-502], except that operation, maintenance, inspection, and compliance program records need not be retained for three years if rendered obsolete by the establishment and replacement of more recent records, or rendered irrelevant due to HVAC system replacement or redesign. The records required to be maintained by the employer are to be made available to employee's and their designated representative and the Assistant Secretary for examination and copying.

Finally, paragraph (h) (6) proposes to require that whenever the employer ceases to do business records that are required to be maintained by the employer are to be provided to and retained by the successor employer [Ex. 3-440B].

Section 8 (c) of the Act authorizes OSHA to require employers to make, keep, and preserve, and make available to the Secretary or the Director records regarding their activities as prescribed by regulation as appropriate and necessary for the enforcement of the Act or for developing information regarding the causes and prevention of occupational illnesses. As noted earlier, the Agency believes that development of written compliance plans are essential to implementation of a successful IAQ program. The written compliance program, inspection and maintenance records, and operator and maintenance schedules which are required to be established under the proposal, are required

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to be retained under this paragraph. This information essentially documents the desired performance levels of HVAC systems, and the measures necessary to maintain those levels of performance, as well as other measures which should be followed to ensure acceptable indoor air quality. Such data must be available for use by designated persons, current employers, successor employers, and employees as a blueprint for program implementation. Without such data, air quality problems would likely arise due to ignorance of such elements as design occupant densities, equipment schedules, maintenance requirements and frequencies, etc. Records required to be established in response to employee complaints of building-related illness are also required to be retained under this paragraph. Such complaints require the employer to evaluate the need for, and to take if necessary, remedial action to correct observed problems [Ex. 3-1, 3-444B]. Information regarding employee illness is essential in identifying causal factors and trends in adverse health effects. Retention of this health data will aid in the recognition, evaluation and correction of indoor air quality deficiencies which lead to building-related illnesses. Records of building-related illness are proposed to be required to be retained for at least the previous 3 years. OSHA believes that requiring record retention for 3 years of building-related illnesses which occur in nonindustrial environments is reasonable. Such illnesses are not viewed in the same context as industrial illnesses which may be associated with long latency periods, and thus necessitate very long retention periods for health records. Establishment and maintenance of building-related illness records is primarily

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for the purpose of documenting indoor air quality degradation, so that corrective action can be taken. Requiring records to be retained to preserve a 3 year history of building-related illness, is proposed as being reasonable to aid in the tracking of air quality trends and past experiences [Ex. 3-502].

Other records are also required to be retained for at least the previous 3 years, except to the extent they become obsolete. OSHA does not believe that records such as maintenance and operating schedules which become irrelevant due to HVAC system modification or replacement need be retained further. The records required to be retained under this paragraph must be transferred to successor employers. Since these records contain information specific to the building or facility, as opposed to specific employers, such records should be maintained within affected buildings for future use.

Dates: Paragraph (i)

Paragraph (i) proposes to establish an effective date for this standard of sixty (60) days from publication in the Federal Register. A start-up date one year from the effective date is proposed as an adequate period of time for employers to achieve full compliance with all provisions under the rule. The Agency believes that affected employers can develop and implement compliance programs, establish designated smoking areas if smoking is not prohibited, and train employees as proposed under the standard within a one year period from the effective date.

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Appendices: Paragraph (j)

The appendices included with this regulation are intended to be informational and, unless otherwise expressly stated in this section, are not intended to create any additional obligations not otherwise imposed, or to detract or reduce any existing obligations.

K. Specific Questions Posed

OSHA solicits data, views and comment on all provisions proposed in this notice. The Agency sets forth questions below to highlight specific areas in the proposal upon which comment is sought.

*Regulatory Analysis Issues*

(1) Are there any comments on the method used by OSHA to estimate benefits resulting from IAQ provisions of the proposed standard?

(2) Are there studies which document, in quantitative terms, the effectiveness of HVAC maintenance on the decline of indoor air related ailments?

(3) OSHA has estimated a substantial productivity benefit resulting from this proposed standard. What additional studies and other information are available that demonstrate any effect on productivity?

(4) OSHA has preliminarily determined that the direct costs of compliance with this standard will not unduly harm small entities. However, OSHA did not determine how the smoking restrictions in this regulation would affect demand, and therefore profitability, for establishments which provide

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services and commodities which would be affected by the proposal (e.g., restaurants and bars). OSHA requests comments, including empirical data regarding the demand elasticity of such establishments' patrons who will not be permitted to smoke in the presence of employees.

If economic feasibility is shown to be an issue for establishments such as bars and restaurants, what alternative feasible methods of compliance would prevent workers from being exposed to tobacco smoke?

What other workplaces have circumstances under which provisions of this standard may not be feasible?

(5) During renovation and remodelling, what are the specific elements for implementing control measures to minimize degradation of the IAQ of employees performing such activities and employees in other areas of the building? What are the unit costs associated with the implementation of each control (capital and labor)?

(6) Please describe practices in your workplace by providing answers to the following:

- describe the business, SIC code number and number of employees in the establishment.
- what type of ventilation systems are presently being used?
- If carbon dioxide monitoring is conducted, how often is it being done and by whom and what are the associated costs?
- Does your establishment have a policy on IAQ? When and why was it implemented? What are the major

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components? How many employees are affected? What type of costs and cost savings have been associated with such a policy (e.g., operating, maintenance, retrofitting HVAC systems, property damage due to poor IAQ, employee productivity, cleaning, etc.)?

- Is smoking allowed in your establishment? If yes, is it limited to designated smoking areas with separate ventilation?

*Scope and application, paragraph (a)*

(1) Is it necessary and feasible to extend coverage of the entire standard to industrial facilities as well as nonindustrial facilities? Why? Why not? Which provisions lend themselves to application to industrial environments?

(2) Can coverage of the standard feasibly be extended to some industrial facilities but not others? If so, what characteristics distinguish those workplaces in which it is feasible or necessary to apply the standard from those in which it is not?

(3) The regulation as drafted would require employers generally to prohibit smoking by their customers (such as in bars, restaurants, and stores) where not already banned by a government entity if employees would be exposed to ETS from customer smoking. Comment is requested on the appropriateness of this provision, possible alternatives, and feasibility issues.

*Definitions, paragraph (b)*

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(1) Is the proposed definition of "air contaminants" sufficiently descriptive to inform employers of the hazards which may adversely affect indoor air quality? If not, what additional information should be included in the definition? Which elements included in the definition are not reflective of hazards which affect indoor air quality?

Can employers reasonably be expected to be able to detect the presence of air contaminants, as defined, and determine whether they present a significant risk of material impairment of employee health? What methods are available to detect indoor air contaminants? What criteria should be used to evaluate the degree of risk that the presence of air contaminants pose to employees?

(2) Is the proposed definition of "building systems" sufficiently descriptive to indicate which systems the employer must attend to in order to assure acceptable indoor air quality? Are the systems listed in the definition those that directly affect indoor air quality? If not, why not? What other systems affect indoor air quality that are not specifically cited in the definition, and how do they influence indoor air quality? How must such systems be maintained and operated in order to assure adequate indoor air quality?

(3) Is the term "building-related illness" sufficiently descriptive and inclusive of the medical conditions that can arise from poor indoor air quality? If not, what other medical conditions should be addressed under the definition and why? Which conditions listed in the definition, if any, should not be considered as "building-related illness" and why?

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(4) Is it necessary and appropriate to require employers to authorize a "designated person" to be responsible for ensuring compliance with an indoor air quality standard? Why? Why not? If it is appropriate to require a designated person, what training should designated persons have in order to carry out their responsibilities under the proposed rule? Should the designated person be a person who is a full-time employee who is within the facility each day? Should a designated person be on-site during each shift? Is it unreasonable to expect that due to the complexity of building systems, a single designated person within a facility can successfully oversee and ensure adequate operation of all building systems that affect indoor air quality? Why? Why not? Would it be beneficial for the designated person to receive an inventory of chemical and physical agents used by all employers on site in order to track chemical usage and storage? Information collected could include date of receipt, amount applied or used, where and when in the facility it was used, and how the remainder is stored.

(5) Does the definition of the term "HVAC system" identify all components of HVAC systems which can adversely affect indoor air quality if not properly operated and maintained? What other components should be included and why? What components designated in the definition do not affect indoor air quality and why?

(6) Is the definition of "nonindustrial work environment" sufficiently descriptive to differentiate them from industrial work environments? If not, what other descriptors should be included in the definition? Which types of facilities and

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establishments proposed under the definition as nonindustrial work environments should not be subject to this standard and why?

(7) Is the definition of "renovation and remodeling" appropriately descriptive of such activities? If not, what modifications to the definition would more reasonably reflect industry view of the characteristics of such activities?

*Indoor Air Quality compliance program, paragraph (c)*

(1) Is it necessary and appropriate to require employers to establish a written IAQ compliance program in order to assure the adequacy of indoor air quality in nonindustrial work environments? Why? Why not?

(2) If establishment of a written compliance program is necessary, are the informational elements proposed to be developed under this rule appropriate and why? What is their function for successful implementation of the program? Which other written material should be made part of the IAQ compliance program and why?

(3) Which informational elements proposed to be established as part of the IAQ program, if any, are irrelevant to successful building system operation and maintenance? Why?

(4) Which informational elements proposed to be established as part of the IAQ program, if any, are not generally available to the employer and why?

*Compliance program implementation, paragraph (d)*

(1) Which of the implementation actions proposed under this paragraph are necessary and appropriate for maintenance of

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acceptable indoor air quality. Why? Which are not? Why not? In this regard, specific comment is particularly sought on the need for the following proposed elements of the implementation program:

- (a) Maintenance and operation of the HVAC system to provide at least a required minimum outside air ventilation rate;
- (b) Operation of the HVAC during all work shifts;
- (c) Use of exhaust ventilation during maintenance and housekeeping activities;
- (d) Maintenance of relative humidity to below 60%;
- (e) Requiring HVAC system evaluation where CO<sub>2</sub> levels exceed 800 ppm; and
- (f) Requiring building system evaluation in response to employee complaints of building related illness.
- (g) Should the regulation prohibit the storage of hazardous substances in air transport pathways serving as return air plenums? These areas may include area-ways, plenums, chases, corridors, and mechanical rooms serving as return air plenums.

*Controls for specific contaminant sources, paragraph (e)*

- (1) Will the proposed provisions addressing construction and operation of designated smoking areas assure that employees working outside designated areas will not be exposed to ETS? If so, which of the proposed provisions may be unnecessary to achieve this goal? If not, is it necessary to prohibit smoking within indoor workplaces to eliminate exposure to ETS or can the provisions as proposed be modified, or supplemented to prevent secondary exposure? If it is believed that designated smoking

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areas will effectively contain tobacco smoke, comment is particularly sought on the appropriateness of requiring designated smoking areas to be enclosed, exhausted directly to the outside and maintained under negative pressure.

(2) Is the proposed provision requiring the use of measures such as local source capture exhaust ventilation or substitution to control air contaminants emitted from point sources where general ventilation is inadequate, feasible or effective?

(3) Are the proposed provisions addressing control of microbial contamination effective, feasible, or necessary? Why? Why not? What additional provisions, if any, should be included to preclude microbial contamination for adversely affecting indoor air quality?

(4) Where hazardous chemicals are used in the workplace, including cleaning and maintenance chemicals, is employee notification of their use 24 hours prior to their application, as proposed, necessary to mitigate potential incidental exposure to such chemicals? To what extent does the use of such chemicals in nonindustrial environments present a health risk to other employees, or to the acceptability of indoor air quality? Which chemicals and their uses are of particular concern in non-industrial indoor environments?

(5) Are the proposed provisions specifically addressing renovation and remodeling activities necessary and appropriate and why? Particularly, are the proposed requirements to develop a work plan focusing special attention on HVAC systems, area isolation or containment, and air contaminant suppression controls necessary to limit the potential for degradation of air

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quality? Why? Why not? What other provisions, if any, should be included to limit the affects that renovation and remodeling activities may have on indoor environments?

*Employee information and training, paragraph (g)*

(1) Are the provisions proposing that building systems maintenance workers receive special training with respect to the use of personal protective equipment, use of ventilation during cleaning and maintenance activities, and on proper use and disposal of hazardous chemicals and other agents, necessary and appropriate to assure maintenance of acceptable indoor air quality? Why? Why not?

(2) Should training of building maintenance and systems workers include additional specific elements not proposed in this notice? What should this additional training consist of and why? Which workers should this training be provided to - all maintenance and building systems workers, supervisors, crew leaders? Should such training be provided periodically, or would initial training suffice?

(3) Is it necessary, as proposed, to require that all employees in the facility be informed of the contents of the standard and of signs and symptoms associated with building-related illness? Why? Why not?

*Recordkeeping, paragraph (h)*

(1) Will retention of records, as proposed, enhance the potential for reducing indoor air quality problems? Will retention of maintenance records, IAQ compliance program records,

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and records of employee complaints serve as necessary documentation upon which actions and decisions can be made to improve deficiencies found in facility air quality? If so, how will these records serve that purpose?

(2) What length of time should the records required to be established under this proposal be required to be retained? Is OSHA's proposed 3-year retention period reasonable? Why? Why not? Should different retention periods be specified for each particular record, and if so, why?

(3) Is it reasonable to require transfer of records from an employee to a successor employer? What other mechanisms are available to ensure that the facility-specific records remain at the building or facility in the event of tenant turnover?

*Dates, paragraph (i)*

Is it feasible for employees to fully implement the provisions of this notice within one year of the effective date, as proposed? Why? Why not? If not, which provisions present difficulties, technologic or economic, with respect to implementation? For which provisions should implementation periods be either decreased or increased and why? To what extent should implementation periods be decreased or increased for particular provisions?

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## VIII. STATE PLAN STANDARDS

The 25 states and territories with their own OSHA-approved occupational safety and health plans must adopt a comparable standard within six months of the publication date of a final standard. These 25 states are: Alaska, Arizona, California, Connecticut (for public employees only), New York (for state and local government employees only), Hawaii, Indiana, Iowa, Kentucky, Maryland, Michigan, Minnesota, Nevada, New Mexico, North Carolina, Oregon, Puerto Rico, South Carolina, Tennessee, Utah, Vermont, Virginia, Virgin Islands, Washington, and Wyoming. Until such time as a state standard is promulgated, Federal OSHA will provide interim enforcement assistance, as appropriate, in these states.

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## IX. FEDERALISM

This Notice of Proposed Rulemaking has been reviewed in accordance with Executive Order 12612 (52 FR 41685, October 30, 1987), regarding Federalism. This Order requires that agencies, to the extent possible, refrain from limiting state policy options, consult with states prior to taking any actions which would restrict state policy options, and take such actions only when there is clear constitutional authority and the presence of a problem of national scope. The Order provides for preemption of state law only if there is a clear Congressional intent for the Agency to do so. Any such preemption is to be limited to the extent possible.

Section 18 of the Occupational Safety and Health Act (OSH Act) expresses Congress' clear intent to preempt state laws relating to issues on which Federal OSHA has promulgated occupational safety and health standards. Under the OSH Act, a state can avoid preemption only if it submits, and obtains Federal approval of, a plan for the development of such standards and their enforcement. Therefore states with occupational safety and health plans approved under Section 18 of the OSHA Act will be able to develop their own state standards to deal with any special problems which might be encountered in a particular state.

The proposed Federal standard on indoor air quality addresses hazards which are not unique to any one state or region of the country. In fact, OSHA recognizes that many state and local governments have enacted provisions addressing indoor air quality issues including the presence of ETS. Section 18(a) of

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the OSH Act requires preemption only of state laws that qualify as occupational safety and health standards, not of state laws of general applicability. It is OSHA's intent that state laws consistent with this standard remain in effect to the maximum extent permitted.

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## X. INFORMATION COLLECTION REQUIREMENTS

5 CFR part 1320 sets forth procedures for agencies to follow in obtaining OMB clearance for information collection requirements under the Paperwork Reduction Act of 1980, 44 U.S.C. 3501 et seq. This proposed indoor air quality standard requires the employer to allow OSHA access to records. In accordance with the provisions of the Paperwork Reduction Act and the regulations issued pursuant thereto, OSHA certifies that it has submitted the information collection requirements for this proposal to OMB for review under section 3504(h) of that Act.

Public reporting burden for this collection of information is estimated to average five minutes per response. Send any comments regarding this burden estimate, or any other aspect of this collection of information, including suggestions for reducing this burden, to the Office of Information Management, Department of Labor, Room N-1301, 200 Constitution Avenue, NW., Washington, D.C. 20210; and to the Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, D.C. 20503.

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## XI. PUBLIC PARTICIPATION

Interested persons are requested to submit written data, views and arguments concerning this proposal. Responses to the questions raised at various places in the proposal are particularly encouraged. These comments must be postmarked by (enter date 90 days after publication of this proposal in the Federal Register). Comments are to be submitted in quadruplicate or 1 original (hardcopy) and 1 disk (5 1/4 or 3 1/2) in WP 5.0, 5.1, 6.0 or Ascii. Note: Any information not contained on disk, e.g., studies, articles, etc., must be submitted in quadruplicate to: The Docket Office, Docket No. H-122, Room N-2625, U.S. Department of Labor, 200 Constitution Avenue, N.W., Washington, D.C. 20210, Telephone No. (202) 219-7894.

All written comments received within the specified comment period will be made a part of the record and will be available for public inspection and copying at the above Docket Office address.

### Notice of Intention to Appear at the Informal Hearing

Pursuant to section 6(b)(3) of the OSH Act, informal public hearings will be held on this proposal in Washington, D.C. from July 12 through July 26, 1994. If OSHA receives sufficient requests to participate in the hearing, the hearing period may be extended.

The hearing will commence at 9:30 a.m. in the auditorium of the Frances Perkins Building, U.S. Department of Labor, 3rd Street and Constitution Avenue N.W., Washington, D.C. 20210.

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Persons desiring to participate at the informal public hearing must file a notice of intention to appear by (75 days after date of publication in the Federal Register). The notice of intention to appear must contain the following information:

1. The name, address, and telephone number of each person to appear;
2. The capacity in which the person will appear;
3. The approximate amount of time required for the presentation;
4. The issues that will be addressed;
5. A brief statement of the position that will be taken with respect to each issue; and
6. Whether the party intends to submit documentary evidence and, if so, a brief summary of it.

The notice of intention to appear shall be mailed to Mr. Thomas Hall, OSHA Division of Consumer Affairs, Docket No. H-122, U.S. Department of Labor, room N-3647, 200 Constitution Avenue, N.W., Washington, D.C. 20210, telephone (202) 219-8615.

A notice of intention to appear also may be transmitted by facsimile to (202) 219-5986, by the same date provided the original and 3 copies are sent to the same address and postmarked no later than 3 days later.

#### Filing of Testimony and Evidence Before the Hearing

Any party requesting more than ten (10) minutes for presentation at the informal public hearing, or who intends to submit documentary evidence, must provide in quadruplicate the testimony and evidence to be presented at the informal public

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hearing. One copy shall not be stapled or bound and be suitable for copying. These materials must be provided to Mr. Thomas Hall, OSHA Division of Consumer Affairs at the address above and be postmarked no later than (90 days after date of publication in the Federal Register).

Each submission will be reviewed in light of the amount of time requested in the notice of intention to appear. In instances where the information contained in the submission does not justify the amount of time requested, a more appropriate amount of time will be allocated and the participant will be notified of that fact prior to the informal public hearing.

Any party who has not substantially complied with the above requirement may be limited to a ten-minute presentation and may be requested to return for questioning at a later time.

Any party who has not filed a notice of intention to appear may be allowed to testify for no more than 10 minutes as time permits, at the discretion of the Administrative Law Judge, but will not be allowed to question witnesses.

Notice of intention to appear, testimony and evidence will be available for inspection and copying at the Docket Office at the address above.

#### Conduct and Nature of Hearing

The hearing will commence at 9:30 a.m. on the first day. At that time, any procedural matters relating to the proceeding will be resolved.

The nature of an informal rulemaking hearing is established in the legislative history of section 6 of the OSH Act and is

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reflected by OSHA's rules of procedure for hearings (29 CFR 1911.15(a)). Although the presiding officer is an Administrative Law Judge and questioning by interested persons is allowed on crucial issues, the proceeding is informal and legislative in type. The Agency's intent, in essence, is to provide interested persons with an opportunity to make effective oral presentations which can proceed expeditiously in the absence of procedural restraints which impede or protract the rulemaking process.

Additionally, since the hearing is primarily for information gathering and clarification, it is an informal administrative proceeding rather than an adjudicative one. The technical rules of evidence, for example do not apply. The regulations that govern hearings and the pre-hearing guidelines to be issued for this hearing will ensure fairness and due process and also facilitate the development of a clear, accurate and complete record. Those rules and guidelines will be interpreted in a manner that furthers that development. Thus, questions of relevance, procedure and participation generally will be decided so as to favor development of the record.

The hearing will be conducted in accordance with 29 CFR Part 1911. It should be noted that §1911.4 specifies the Assistant Secretary may upon reasonable notice issue alternatives procedures to expedite proceedings or for other good cause. The hearing will be presided over by an Administrative Law Judge who makes no decision or recommendation on the merits of OSHA's proposal. The responsibility of the Administrative Law Judge is to ensure that the hearing proceeds at a reasonable pace and in an orderly manner. The Administrative Law Judge, therefore, will

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have all the powers necessary and appropriate to conduct a full and fair informal hearing as provided in 29 CFR Part 1911 including the powers:

1. To regulate the course of the proceedings;
2. To dispose of procedural requests, objections and comparable matters;
3. To confine the presentations to the matters pertinent to the issues raised;
4. To regulate the conduct of those present at the hearing by appropriate means;
5. In the Judge's discretion, to question and permit the questioning of any witness and to limit the time for questioning; and
6. In the Judge's discretion, to keep the record open for a reasonable, stated time (known as the post-hearing comment period) to receive written information and additional data, views and arguments from any person who has participated in the oral proceedings.

OSHA recognizes that there may be interested persons or organizations who, through their knowledge of the subject matter or their experience in the field, would wish to endorse or support the whole proposal or certain provisions of the proposal. OSHA welcomes such supportive comments, including any pertinent data and cost information which may be available, in order that the record of this rulemaking will present a balanced picture of the public response on the issues involved.

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XII. List of Subjects in 29 CFR Part 1910

Indoor Air Quality, Occupational Safety and Health.

XIII. Authority and Signature

This document was prepared under the direction of Joseph A. Dear, Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, 200 Constitution Avenue NW., Washington, D.C. 20210. Pursuant to sections 6(b) and 8(c) and 8(g)(2) of the Act, OSHA hereby proposes to amend 29 CFR by adding a new § 1910.1033, 1915.1033, 1926.1133 and revising of § 1910.19 and 1928.21 as set forth below.

Signed at Washington, D.C., this \_\_\_\_\_ day of \_\_\_\_\_, 199\_\_\_.

**Joseph A. Dear,**

Assistant Secretary for Occupational Safety and Health.

Part 1910, 1915, 1926, and 1928 of title 29 of the Code of Federal Regulation (CFR) are hereby proposed to be amended as follows:

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#### XIV. STANDARDS

##### PART 1910, 1915, 1926 [AMENDED] -- OCCUPATIONAL SAFETY AND HEALTH STANDARDS

1. The authority citation for subpart B of Part 1910 would continue to read as follows:

AUTHORITY: Secs. 4, 6, and 8 of the Occupational Safety and Health Act, 29 U.S.C. 653, 655, 657; Walsh-Healey Act, 41 U.S.C. 35 et seq; Service Contract Act of 1965, 41 U.S.C. 351 et seq; sec. 107, Contract Work Hours and Safety Standards Act (Construction Safety Act), 40 U.S.C. 333; sec. 41, Longshore and Harbor Workers' Compensation Act, 33 U.S.C. 942; National Foundation of Arts and Humanities Act, 20 U.S.C. 951 et seq; Secretary of Labor's Order No. 12-71 (36 FR 8754), 8-76 (41 FR 1911), 9-83 (48 FR 35736), or 1-90 (55 FR 9033), as applicable.

2. The authority citation for subpart Z of Part 1910 would continue to read as follows:

AUTHORITY: Secs. 6, 8 of the Occupational Safety and Health Act, 29 U.S.C. 653, 655, 657; Secretary of Labor's Order No. 12-71 (36 FR 8754), 8-76 (41 FR 1911), 9-83 (48 FR 35736), or 1-90 (55 FR 9033), as applicable; and 29 CFR 1911.

All of subpart Z issued under section 6(b) of the Occupational Safety and Health Act, except those substances which have exposure limits listed in Tables Z-1, Z-2, and Z-3 of 29 CFR 1910.1000. The latter were issued under Section 6(a) (29 U.S.C. 655(a)).

Section 1910.1000, Tables Z-1, Z-2, and Z-3 also issued under 5 U.S.C. 533. Section 1910.1000, Tables Z-1, Z-2, and Z-3

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were not issued under 29 CFR 1911 except for the arsenic (organic compounds), benzene and cotton dust listings.

Section 1910.1001 also issued under Sec. 107 of Contract Work Hours and Safety Standards Act, 40 U.S.C. 333.

Section 1910.1002 not issued under 29 U.S.C. 655 or 29 CFR Part 1911; also issued under 5 U.S.C. 553.

Section 1910.1025 also issued under 5 U.S.C. 553.

Section 1910.1043 also issued under 5 U.S.C. 551 et seq.

Sections 1910.1200, 1910.1499, and 1910.1500 also issued under 5 U.S.C. 553.

3. The authority citation for part 1915 would continue to read as follows.

AUTHORITY: Sec. 41, Longshore and Harbor Workers Compensation Act (33 U.S.C. 941); secs. 4, 6, 8 Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, 657); sec. 4 of the Administrative Procedure Act (5 U.S.C. 553); Secretary of Labor's Order No. 12-71 (36 FR 8754), 8-76 (41 FR 25059), 9-83 (48 FR 35736) or 1-90 (55 FR 9033), as applicable; 29 CFR Part 1911.

4. The authority citation for subpart Z of Part 1926 would be revised to read as follows:

AUTHORITY: Sec. 107, Contract Work Hours and Safety Standards Act (Construction Safety Act) (40 U.S.C. 333); Secs. 6, 8 of the Occupational Safety and Health Act, 29 U.S.C. 653, 655, 657; Secretary of Labor's Order No. 12-71 (36 FR 8754), 8-76 (41 FR 1911), 9-83 (48 FR 35736), or 1-90 (55 FR 9033), as applicable; and 29 CFR 1911.

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Section 1926.1102 not issued under 29 U.S.C. 655 or 29 CFR Part 1911; also issued under 5 U.S.C. 653.

Section 1926.1103 through 1926.1118 also issued under 29 U.S.C. 653.

Section 1926.1128 also issued under 29 U.S.C. 653.

Section 1926.1145 and 1926.1147 also issued under 29 U.S.C. 653.

Section 1926.1148 also issued under 29 U.S.C. 653.

5. Section 1910.19 of subpart B of part 1910 is proposed to be amended by adding a paragraph (1) to read as follows:

§ 1910.19 Special provisions for air contaminants

\* \* \* \* \*

(1) Indoor air quality. Section 1910.1033 shall apply to the exposure of every employee in every employment covered by section 1910.16.

6. Subpart Z of Parts 1910, 1915, 1926 of Title 29 of the Code of Federal Regulations is proposed to be amended by adding identical new sections as 1910.1033, 1915.1033 and 1926.1133 to read as follows:

§ \*\*\*\*\*.\*\*\*\*\* Indoor Air Quality.

(a) *Scope and application.* (1) The provisions set forth in this section apply to all nonindustrial work environments.

(2) The provisions set forth in paragraph (e)(1) of this section, which address employee exposure to tobacco smoke, apply to all indoor or enclosed workplaces under OSHA jurisdiction.

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(b) Definitions

*Air contaminants* refers to substances contained in the vapors from paint, cleaning chemicals, pesticides, and solvents, particulates, outdoor air pollutants and other airborne substances which together may cause material impairment to employees working within the nonindustrial environment.

*Assistant Secretary* means the Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, or designee.

*Building-Related Illness* describes specific medical conditions of known etiology which can be documented by physical signs and laboratory findings. Such illnesses include sensory irritation when caused by known agents, respiratory allergies, asthma, nosocomial infections, humidifier fever, hypersensitivity pneumonitis, Legionnaires' disease, and the signs and symptoms characteristic of exposure to chemical or biologic substances such as carbon monoxide, formaldehyde, pesticides, endotoxins, or mycotoxins.

*Building systems* include but are not limited to the heating, ventilation and air-conditioning (HVAC) system, the potable water systems, the energy management system and all other systems in a facility which may impact indoor air quality.

*Designated person* means a person who has been given the responsibility by the employer to take necessary measures to assure compliance with this section and who is knowledgeable in the requirements of this standard and the specific building systems servicing the affected building or office.

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*Designated smoking area* means a room, in a non-work area, in which smoking of tobacco products is permitted.

*Director* means the Director, National Institute for Occupational Safety and Health (NIOSH) U.S. Department of Health and Human Services or designee.

*Employer* means all persons defined as employers by Sec. 3(5) of the Occupational Safety and Health Act of 1970 including employers (such as building owners or lessees) who control the ventilation or maintenance of premises where employees of other employers work.

*HVAC system* means the collective components of the heating, ventilation and air-conditioning system including, but not limited to, filters and frames, cooling coil condensate drip pans and drainage piping, outside air dampers and actuators, humidifiers, air distribution ductwork, automatic temperature controls, and cooling towers.

*Nonindustrial work environment* means an indoor or enclosed work space such as, but not limited to, offices, educational facilities, commercial establishments, and healthcare facilities, and office areas, cafeterias, and break rooms located in manufacturing or production facilities used by employees. Non-industrial work environments do not include manufacturing and production facilities, residences, vehicles, and agricultural operations.

*Renovation and remodeling* means building modification involving activities that include but are not limited to: removal or replacement of walls, ceilings, floors, carpet, and components such as moldings, cabinets, doors, and windows; painting,

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decorating, demolition, surface refinishing, and removal or cleaning of ventilation ducts.

(c) *Indoor air quality (IAQ) compliance program*

(1) All employers with workplaces covered by paragraph

(a)(1) of this section shall establish a written IAQ compliance program.

(2) The employer shall identify a designated person who is given the responsibility to assure implementation of the IAQ compliance program.

(3) Written plans for compliance programs shall include at least the following:

(i) A written narrative description of the facility building systems;

(ii) Single-line schematics or as-built construction documents which locate major building system equipment and the areas that they serve;

(iii) Information for the daily operation and management of the building systems, which shall include at least a description of normal operating procedures, special procedures such as seasonal start-ups and shutdowns, and a list of operating performance criteria including, but not limited to minimum outside air ventilation rates, potable hot water storage and delivery temperatures, range of space relative humidities, and any space pressurization requirements.

(iv) A general description of the building and its' function including but not limited to, work activity,

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number of employees and visitors, hours of operation, weekend use, tenant requirements and known air contaminants released in the space;

(v) A written maintenance program for the maintenance of building systems which shall be preventive in scope and reflect equipment manufacturer's recommendations and recommended-good-practice as determined by the building systems maintenance industry. At a minimum, the maintenance program shall describe the equipment to be maintained, and establish maintenance procedures and frequency of performance.

(vi) A checklist for the visual inspection of building systems.

(4) The following additional information, if available, shall be retained by the employer to assist in potential indoor air quality evaluations:

(i) As-built construction documents;

(ii) HVAC system commissioning reports;

(iii) HVAC systems testing, adjusting and balancing reports;

(iv) Operations and maintenance manuals;

(v) Water treatment logs; and

(vi) Operator training materials

(5) The employer shall establish a written record of employee complaints of signs or symptoms that may be related to building-related illness to include at least information on the nature of the illness reported, number of employees affected, date of employee

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complaint, and remedial action, if any, taken to correct the source of the problem.

(d) *Compliance program implementation*. Employers shall assure compliance with this section by implementing at least the following actions:

- (1) Maintain and operate the HVAC system to assure that it operates up to original design specifications and continues to provide at least the minimum outside air ventilation rate, based on actual occupancy, required by the building code, mechanical code, or ventilation code applicable at the time the facility was constructed, renovated, or remodeled, whichever is most recent;
- (2) Conduct building systems inspections and maintenance in accordance with paragraph (c);
- (3) Assure that the HVAC system is operating during all work shifts, except during emergency HVAC repairs and during scheduled HVAC maintenance;
- (4) Implement the use of general or local exhaust ventilation where housekeeping and maintenance activities involve use of equipment or products that could reasonably be expected to result in hazardous chemical or particulate exposures to employees working in other areas of the building or facility;
- (5) Maintain relative humidity below 60% in buildings with mechanical cooling systems;
- (6) The employer shall monitor carbon dioxide levels when routine maintenance under paragraph (d)(1) is done. When the carbon dioxide level exceeds 800 ppm, the employer shall

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check to make sure the HVAC system is operating as it should. If it is not, the employer shall take necessary steps to correct deficiencies if they exist.

(7) Assure that buildings without mechanical ventilation are maintained so that windows, doors, vents, stacks and other portals designed or used for natural ventilation are in operable condition;

(8) Assure that mechanical equipment rooms and any non-ducted air plenums or chases that transport air are maintained in a clean condition, hazardous substances are properly stored to prevent spillage, and asbestos, if friable, is encapsulated or removed so that it does not enter the air distribution system;

(9) Assure that inspections and maintenance of building systems are performed by or under the supervision of the designated person;

(10) Establish a written record of building system inspections and maintenance required to be performed under this section; and

(11) Assure that employees performing work on building systems are provided with and use appropriate personal protective equipment as prescribed in 29 CFR 1926, Subpart E, Personal Protective and Life Saving Equipment; 29 CFR 1926.52, Occupational Noise Exposure; 29 CFR 1910, Subpart I, Personal Protective Equipment; and 29 CFR 1910.95 Occupational Noise Exposure.

(12) Evaluate the need to perform alterations of the building systems to meet the minimum requirements specified

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in paragraph (d) of this section in response to employee complaints of building-related illnesses.

(13) Take such remedial measures as the evaluation shows to be necessary.

(e). *Controls for specific contaminant sources.*

(1) *Tobacco smoke.*

(i) In workplaces where the smoking of tobacco products is not prohibited, the employer shall establish designated smoking areas and permit smoking only in such areas;

(ii) The employer shall assure that designated smoking areas are enclosed and exhausted directly to the outside, and are maintained under negative pressure (with respect to surrounding spaces) sufficient to contain tobacco smoke within the designated area;

(iii) The employer shall assure that cleaning and maintenance work in designated smoking areas is conducted only when no smoking is taking place;

(iv) The employer shall assure that employees are not required to enter designated smoking areas in the performance of normal work activities;

(v) The employer shall post signs clearly indicating areas that are designated smoking areas; and

(vi) The employer shall post signs that will clearly inform anyone entering the workplace that smoking is restricted to designated areas.

(vii) The employer shall prohibit smoking within designated smoking areas during any period that the

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exhaust ventilation system servicing that area is not properly operating.

(2) *Other indoor air contaminants.*

(i) The employer shall implement measures such as the relocation of air intakes and other pathways of building entry, where necessary, to restrict the entry of outdoor air contaminants such as vehicle exhaust fumes, into the building;

(ii) When general ventilation is inadequate to control air contaminants emitted from point sources within workspaces the employer shall implement other control measures such as local source capture exhaust ventilation or substitution.

(3) *Microbial contamination.*

(i) The employer shall control microbial contamination in the building by routinely inspecting for, and promptly repairing, water leaks that can promote growth of biologic agents;

(ii) The employer shall control microbial contamination in the building by promptly drying, replacing, removing, or cleaning damp or wet materials; and

(iii) The employer shall take measures to remove visible microbial contamination in ductwork, humidifiers, other HVAC and building system components, or on building surfaces when found during regular or emergency maintenance activities or during visual inspection.

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(4) *Use of cleaning and maintenance chemicals, pesticides, and other hazardous chemicals in the workplace.*

(i) The employer shall assure that these chemicals are used and applied according to manufacturers' recommendations; and

(ii) The employer shall inform employees working in areas to be treated with potentially hazardous chemicals, at least within 24 hours prior to application, of the type of chemicals intended to be applied.

(f) *Air quality during renovation and remodeling.*

(1) *General.* During renovation or remodeling, the employer shall assure that work procedures and appropriate controls are utilized to minimize degradation of the indoor air quality of employees performing such activities and employees in other areas of the building.

(2) *Work plan development.*

(i) Before remodeling, renovation, or similar activities are begun the employer shall meet with the contractor or individual(s) performing the work and shall develop and implement a work plan designed to minimize entry of air contaminants to other areas of the building during and after performance of the work; and

(ii) The work plan shall consider all of the following where appropriate:

(A) Requirements of this standard.

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- (B) Implementation of means to assure that HVAC systems continue to function effectively during remodeling and renovation activities.
  - (C) Isolation or containment of work areas and appropriate negative pressure containment;
  - (D) Air contaminant suppression controls or auxiliary air filtration/cleaning.
  - (E) Controls to prevent air contaminant entry into the HVAC air distribution system.
- (3) Prior notification of employees who work in the building.
- (i) The employer shall notify employees at least 24 hours in advance, or promptly in emergency situations, of work to be performed on the building that may introduce air contaminants into their work area;
  - (ii) Notification shall include anticipated adverse impacts on indoor air quality or workplace conditions.
- (g) Employee information and training.
- (1) The employer shall provide training for maintenance workers and workers involved in building system operation and maintenance which shall include at least the following:
- (i) Training in the use of personal protective equipment (PPE) needed in operating and maintaining building systems;
  - (ii) Training on how to maintain adequate ventilation of air contaminants generated during building cleaning and maintenance; and

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- (iii) Training of maintenance personnel on how to minimize adverse effects on indoor air quality during the use and disposal of chemicals and other agents.
- (2) All employees shall be informed of:
- (i) The contents of this standard and its appendices; and
- (ii) Signs and symptoms associated with building-related illness and the requirement under subparagraphs (d)(12) and (d)(13) of this section directing the employer to evaluate the effectiveness of the HVAC system and to take remedial measures to the HVAC system if necessary, upon receipt of complaints from employees of building-related illness.
- (3) Availability of training material. The employer shall make training materials developed in response to paragraph (g), including this standard and its appendices, available for inspection and copying by employees, designated employee representatives, the Director, and the Assistant Secretary.
- (h) Recordkeeping. (1) Maintenance records. The employer shall maintain inspection and maintenance records required to be established under paragraph (d), which shall include the specific remedial or maintenance actions taken, the name and affiliation of the individual performing the work, and the date of the inspection or maintenance activity.
- (2) Written IAQ compliance program. The employer shall maintain the written compliance program and plan required to be established under paragraph (c) of this section.

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(3) *Employee complaints.* The employer shall maintain a record of employee complaints of signs or symptoms that may be associated with building-related illness required to be established under paragraph (c)(5) of this section. These complaints shall be promptly transmitted to the designated person for resolution.

(4) *Retention of records.* The employer shall retain records required to be maintained under this section for at least the previous three years, except that records required to be maintained under paragraphs (h)(1) and (h)(2) of this section need not be retained for three years if rendered obsolete by the establishment and replacement of more recent records, or rendered irrelevant due to HVAC system replacement or redesign.

(5) *Availability.* The records required to be maintained by this paragraph shall be available on request to employees and their designated representative and the Assistant Secretary for examination and copying.

(6) *Transfer of records.*

Whenever the employer ceases to do business, records that are required to be maintained by paragraph (h) of this section shall be provided to and retained by the successor employer.

(i) *Dates--(1) Effective date.* This section shall become effective [INSERT DATE 60 DAYS FROM PUBLICATION]

2. *Start-up dates.*

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(i) Employers shall have implemented all provisions of this standard no later than one year from the effective date.

(j) Appendices

Appendix A to § 1910.1033---Carbon Dioxide Measurement Protocol  
(Non-Mandatory)

Carbon dioxide (CO<sub>2</sub>) sampling is one of the measurement tools used to characterize indoor air quality. Indoor CO<sub>2</sub> air concentrations are indicator measures for effectiveness of building ventilation. Elevated carbon dioxide levels can be an indicator of inadequate outside air exchange rates. Carbon dioxide concentrations below 800 ppm generally indicate that the ventilation is adequate for diluting occupant-generated contaminants. The carbon dioxide concentration and the associated outside air ventilation rate offers no confidence as to the adequacy of dilution and removal of other contaminants released in the space. There is also no implication of health effects associated with this level of carbon dioxide, or any implication of a permissible exposure limit. Health effects have been observed in buildings where the carbon dioxide levels were below 800 ppm.

OSHA recommends this procedure:

- 1) Design a program of air sampling that includes samples taken: a) at least every three months to detect the effects of seasonal changes (summer/winter transition seasons); b) after adjustments have been made to the HVAC system, and; c)

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at any time there is reason to believe air quality has deteriorated. At least once a year carbon dioxide levels should be monitored when the HVAC system is providing minimum outside air ventilation.

2) Measure carbon dioxide concentrations late in the morning (about 11:00 am) and late in the afternoon before workers leave for home (about 3:30 pm). These are the times when carbon dioxide levels should be closest to equilibrium levels and should give the best indication of effective air exchange rates. These normal use patterns may be altered by visitor frequency and should be accounted for in the monitoring scheme.

3) Conduct the sampling at a height of between 3 and 5 feet above the floor, or about the height of employee's heads. Make sure the samples are taken at least 2 feet from where people are breathing. Take the samples at a sufficient distance from any other sources of carbon dioxide so these sources do not affect the measurements.

4) Select sampling locations in normally-occupied areas where the ventilation mixing would be the least effective. These areas might include corners of a room farthest from supply ducts and exhaust vents, locations surrounded by barriers that might affect air movement, or rooms at the far end of a ventilation supply duct.

5) Measure the carbon dioxide levels outside the building for comparison with the indoor levels. Average outdoor carbon dioxide levels are typically 300 to 500 ppm.

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6) Use colormetric detector tubes or other direct-reading instruments calibrated and operated according to the manufacturer's instructions for measuring carbon dioxide concentrations.

Take sampling and analytical error into account before comparing results with the 800 ppm benchmark. All measuring devices have a degree of uncertainty associated with the results. An estimate of that uncertainty is called the sampling and analytical error. The uncertainty can be reduced by taking more samples with the same device. Table A-1 can be used to assure 95 percent confidence that the average of the results from a set of detector tube samples is less than 800 ppm. OSHA recommends these following steps:

(1) Calculate the average of the measurements.

(a) Add the detector tube results together.

(b) Divide that total by the number of samples.

(2) Compare the average of the results with the number of samples taken in the second column in the table. If the average is less than the number in the table, there is confidence that the CO<sub>2</sub> levels are less than 800 ppm.

EXAMPLE: Three samples are taken and the results are 650 ppm, 710 ppm, and 680 ppm. The average of these three samples is 680 ppm (2,040 ppm divided by 3). The results indicate confidence that the carbon dioxide levels are less than 800 ppm since the 680 ppm average of the three samples is less than 695 ppm.

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TABLE A-1  
NUMBER OF SAMPLES TAKEN TO ASSURE 95% CONFIDENCE CO<sub>2</sub>  
CONCENTRATIONS ARE LESS THAN 800 PPM

<u>Number of Samples Taken:</u>	<u>The Average Must Be Less Than:</u>
2	670 ppm
3	695 ppm
4	710 ppm
5	720 ppm
6	725 ppm
7	730 ppm

Table A-2 shows how to determine if the indoor sample results are significantly different from the results taken outdoors. Use this table by following these steps:

- (1) Take the same number of samples indoors and outdoors.
- (2) Average the results of the outdoor and indoor samples.
  - (a) Add the outdoor results together and divide by the number of samples taken.
  - (b) Add the indoor results together and divide by the number of samples taken.
- (3) Compare the range of the outdoor and indoor samples.
  - (a) Subtract the lowest sample result of the outdoor samples from the highest result for the outdoor samples.
  - (b) Subtract the lowest sample result of the indoor samples from the highest result for the indoor samples.

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- (4) Calculate Delta, which is a term derived by subtracting the difference between the indoor average and the outdoor average and then multiplying that result times 2.
- (5) Calculate the Sum of the Ranges. Add the outdoor Range and the indoor Range together.
- (6) Calculate the Test Statistic. Divide Delta by the Sum of the Ranges.
- (7) Compare the Test Statistic with the second column in the table below. If the Test Statistic is more than the number found in the column, the difference is significant.

**EXAMPLE:**

- (1) Three samples are taken indoors and three samples are taken outdoors. The results of the outdoor samples are 500 ppm, 580 ppm and 480 ppm. The results of the indoor samples are 650 ppm, 710 ppm, and 680 ppm.
- (2) The average of the outdoor samples is 520 ppm ( $1,560$  ppm divided by 3) and the average of the indoor samples is 680 ppm ( $2,040$  ppm divided by 3).
- (3) The Range of the outdoor samples is 100 ( $580 - 480 = 100$ ) and the Range of the indoor samples is 60 ppm ( $710 - 650$ ).
- (4) "Delta" is 320;  $(680 - 520) \times 2 = 320$ .
- (5) The "Sum of the Ranges" is 160;  $(100 + 60) = 160$ .
- (6) The "Test Statistic" is 2 ( $320$  divided by  $160 = 2$ ).
- (7) Since the "Test Statistic," 2, is greater than the 0.974 found in the table for 3 samples, the indoor air levels of

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carbon dioxide are significantly more than the outdoor air levels.

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TABLE A-2  
DETERMINATION OF THE TEST STATISTIC (IF INSIDE CO<sub>2</sub>  
CONCENTRATION TESTING RESULTS ARE SIGNIFICANTLY  
DIFFERENT FROM OUTSIDE CONCENTRATIONS (95% CONFIDENCE))

<u>Number of Samples Taken:</u>	<u>Test Statistic Must Be More Than:</u>
2	2.322
3	0.974
4	0.644
5	0.493
6	0.405
7	0.347

If the indoor sample results show levels that are greater than 800 ppm or that the indoor levels are significantly more than the outdoor levels, initiate actions to investigate the functioning of the HVAC system and determine if the employees are affected.

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Appendix B: Information sources--Nonmandatory.

The following is a partial list of available data sources which building owners/agents of employers may wish to consult to help identify, characterize, and reduce sources of indoor air pollutants in office work environments. These sources also provide useful information concerning the operation, maintenance, and evaluation of mechanical ventilation systems.

*Building Air Quality: A Guide for Building Owners and Facility Managers.* U.S. EPA/NIOSH. Dec. 1991. EPA/400/1-91/033. DHHS (NIOSH) Publication No. 91-114. Available from Superintendent of Documents, P.O. Box 371954, Pittsburgh, PA 15250-7954.

*Introduction to Indoor Air Quality: 1) Self-Paced Learning Module and 2) A Reference Manual.* U.S. EPA, Office of Air and Radiation. EPA/400/3-91/00. July 1991.

*Managing Indoor Air Quality.* 1991. Shirley J. Hansen. The Fairmont Press, Inc., 700 Indian Trail, Lilburn, GA 30247.

*ASHRAE Standard 62-1989. Ventilation for Acceptable Indoor Air Quality.* American Society of Heating, Refrigeration, and Air-conditioning Engineers, Inc. 1791 Tullie Circle, NE, Atlanta, GA 30329.

*Washington State Ventilation and Indoor Air Quality Code, Chapter 51-13 WAC.* Washington State Building Code Council.

*Indoor Air Quality Workbook.* 1990. D. Jeff Burton. IVE, Inc., 178 North Alta Street, Salt Lake City, Utah 84103.

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Appendix C: Smoking cessation program information--Nonmandatory

The following organizations provide smoking cessation information and program material:

(1) The National Cancer Institute operates a toll-free Cancer Information Service (CIS) with trained personnel to help you. Call 1-800-4-CANCER to reach the CIS office serving your area, or write: Office of Cancer Communications, National Cancer Institute, National Institutes of Health, Building 31, Room 10A24, Bethesda, Maryland 20892.

(2) American Cancer Society, 1599 Clifton Road NE, Atlanta, Georgia 30062, (404) 320-3333. The American Cancer Society (ACS) is a voluntary organization composed of 58 divisions and 3,100 local units. Through "The Great American Smokeout" in November, the annual Cancer Crusade in April, and numerous educational material, ACS helps people learn about the health hazards of smoking and become successful exsmokers.

(3) American Heart Association, 7320 Greenville Avenue, Dallas Texas 75231, (214) 750-5300. The American Heart Association (AHA) is a voluntary organization with 130,000 members (physicians, scientists, and laypersons) in 55 states and regional materials about the effects of smoking on the heart. AHA also has developed a guidebook for incorporating a weight-control component into smoking cessation programs.

(4) American Lung Association, 1740 Broadway, New York, New York 10019, (212) 245-8000. A voluntary organization of 7,500 members (physicians, nurses and laypersons), the American Lung Association (ALA) conducts numerous public information programs

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about the health effects of smoking. ALA has 59 state and 85 local units. The organization actively supports legislation and information campaigns for nonsmokers' rights and provides help for smokers who want to quit, for example through "Freedom From Smoking," a self-help cessation program.

(5) Office on Smoking and Health, United States Department of Health and Human Services, 5600 Fisher Lane, Park Building, Room 110, Rockville, Maryland 20857. The Office of Smoking and Health (OSH) is the Department of Health and Human Services' lead agency in smoking control. OSH has sponsored distribution of publications on smoking-related topics, such as free flyers on relapse after initial quitting, helping a friend or family member quit smoking, the health hazards of smoking, and the effects of parental smoking on teenagers.

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Part 1928-Occupational Safety Standards for Agriculture - Amended

7. The Authority citation for Part 1928 is proposed to continue to read as follows;

AUTHORITY: Secs. 4, 6, 8, Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, 657); Secretary of Labor's order Nos. 12-71 (36 FR 8754), 8-76 (41 FR 25059), 9-83 (48 FR 35736), or 1-90 (55 FR 9033), as applicable; 29 CFR Part 1911.

8. Section 1928.21 is proposed to be amended by adding a new paragraph (a) (6) to the list of Part 1910 standards applicable to Agriculture as follows:

Section 1928.21 Applicable Standards in 29 CFR Part 1910.

(a) \*\*\*

(6) Indoor Air Quality - Section 1910.1033.

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